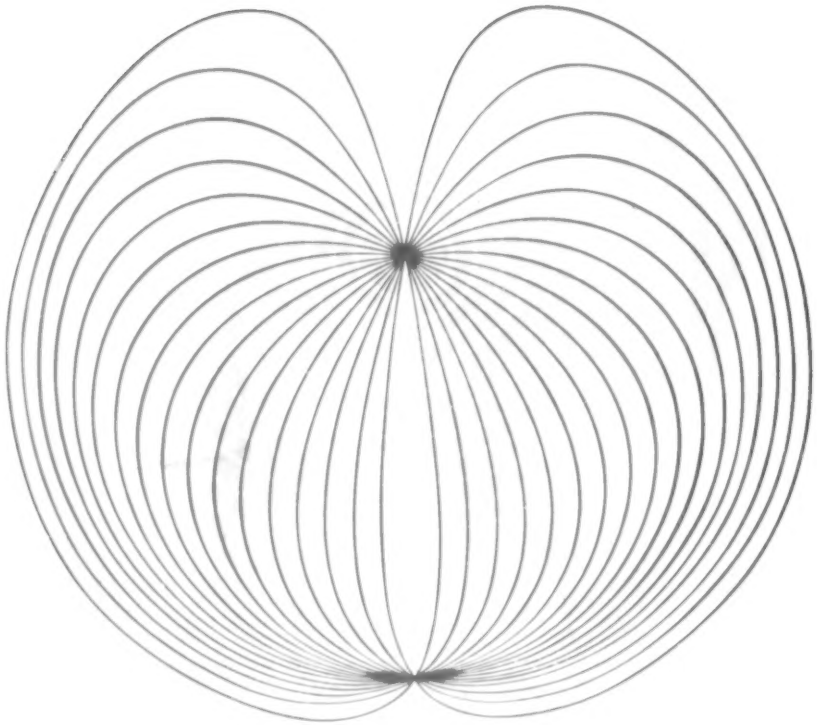
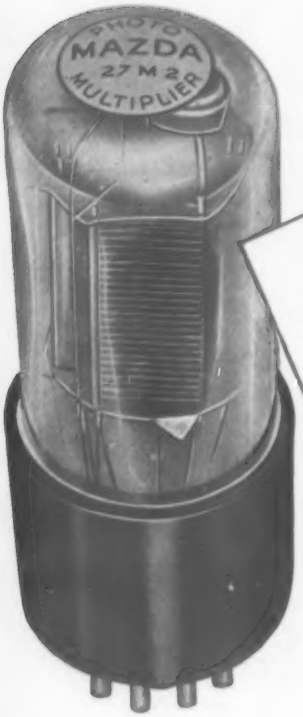
Wireless World

JULY 1954 · TWO SHILLINGS



RADIO, TELEVISION AND ELECTRONICS

VALVES For **SPECIAL PURPOSES**



We are now able to give prompt deliveries of

EDISWAN

MAZDA

*27M1 & 27M2 HIGH-VACUUM PHOTO MULTIPLIERS

Complete details and prices of Ediswan Mazda photo-multipliers will be supplied on request.

* *These valves are plug-in replacements for the American type 931A.*

EDISWAN

MAZDA

VALVES AND CATHODE RAY TUBES

THE EDISON SWAN ELECTRIC CO. LTD., 155 CHARING CROSS ROAD, LONDON, W.C.2

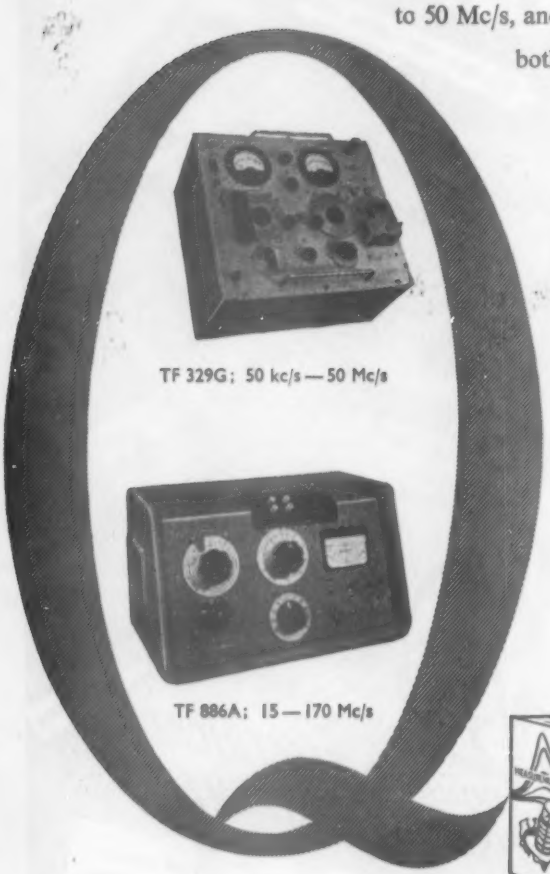
Member of the A.E.I. Group of Companies. *Telephone: Gerrard 8660*

BVI33

ALL-ROUND
DEPENDABILITY
AVO VALVE CHARACTERISTIC METER
AVO ELECTRONIC TESTMETER
AVO UNIVERSAL BRIDGE
AVO ELECTRONIC TEST UNIT
THE D.C. AVO MINOR
AVO WIDE RANGE SIGNAL GENERATOR
AVO
Precision ELECTRICAL
MEASURING INSTRUMENTS
HEAVY DUTY AVO METER
UNIVERSAL AVO MINOR
UNIVERSAL AVO METER
Dependability is an essential quality in any good electrical testing instrument. Absolute dependability is the outcome of good design, suitability for purpose, and a high standard of accuracy. These indispensable factors are exemplified in all "Avo" Instruments, which are also noteworthy for their compact portability and robust construction.
You can depend on "Avo." When choosing instruments, consult our complete catalogue, a copy of which may be had free on application
THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
WINDER HOUSE DOUGLAS STREET LONDON S.W.1
Telephone: VICtoria 2404-9

Q measurement by Marconi

Famous for years in the field of communication measurement, Marconi Instruments offer TF 329G for determinations in frequency range 50 kc/s to 50 Mc/s, and TF 886A for the range 15-170 Mc/s. While both instruments are primarily designed as direct reading Q meters, either may, of course, be employed for a variety of indirect measurements — such as the capacitance and phase defect of condensers — carried out by the normal reasonance methods. In addition, special jigs are available for T F 329G for the investigation of dielectrics.



TF 329G; 50 kc/s — 50 Mc/s

TF 886A; 15 — 170 Mc/s

TF 329G; 50 kc/s—50 Mc/s; 10—500 Q; 40—450 $\mu\mu$F.
TF 886A; 15—170 Mc/s; 60—1200 Q; 12—85 $\mu\mu$F.

May we send you our 44-page booklet **"Measurements by Q Meter"?**

MARCONI INSTRUMENTS

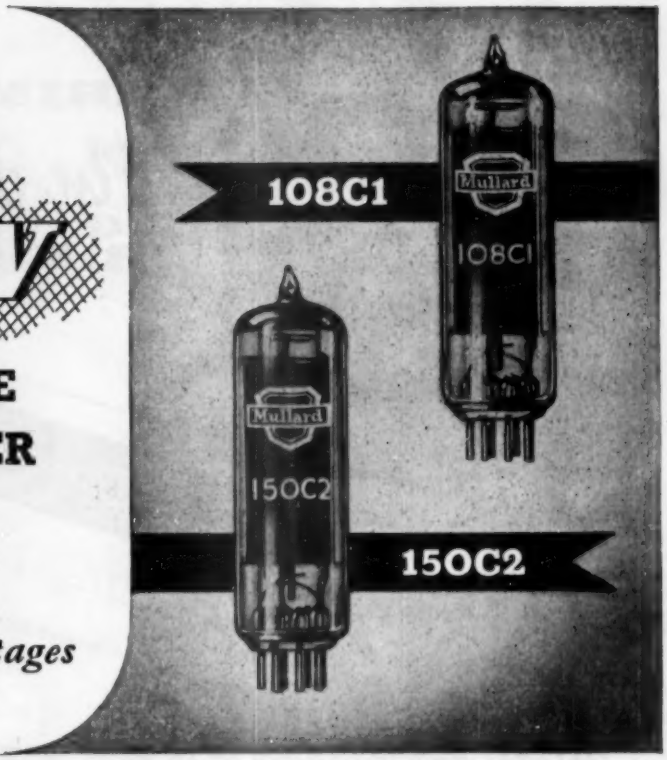
SIGNAL GENERATORS · BRIDGES · VALVE VOLTMETERS · FREQUENCY STANDARDS
WAVEMETERS · WAVE ANALYSERS · BEAT FREQUENCY OSCILLATORS · Q METERS

MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTS · PHONE: ST. ALBANS 6161/7

Midland Office: 19 The Parade, Leamington Spa. **Northern Office:** 30 Albion Street, Kingston-upon-Hull. **Export Office:** Marconi House, Strand, London, W.C.2.

2 NEW VOLTAGE STABILISER TUBES

with low regulation voltages



In order to meet the requirements of designers for stabilisers with very low regulation voltages, Mullard have added to their range two new tubes, the 108C1 and 150C2. They are particularly suitable for simple stabiliser circuits in which a constant output voltage is required over wide variations in input voltage and load current.

The burning voltages of these new stabilisers are 108V and 150V as indicated by their respective type numbers, while the current range is 5 to 30mA in both cases. As shown in the table they are directly interchangeable with American stabilisers 0B2 and 0A2.

For applications in which long term stability of burning voltage is paramount, designers are, of course, recommended to continue using the well-known stabilisers 90C1 and 150B2.

Brief technical details of preferred Mullard voltage stabilisers are shown on this page. Particulars of voltage reference tubes and more comprehensive information on the full range of voltage stabilisers will be gladly supplied on request.

Mullard Type No.	American Type No.	British Services Type No.	Burning Voltage (V)	Burning Current Range (mA)	Max. Ignition Voltage (V)	Maximum Regulation Voltage (V)	Max. Variation of burning voltage during 1,000 hours
90C1	—	—	90	1 to 40	125	14	1%
108C1	0B2	CV1833	108	5 to 30	130	3·8	2%
150B2	—	CV2225	150	5 to 15	180	6·0	1%
150C2	0A2	CV1832	150	5 to 30	180	6·0	2%

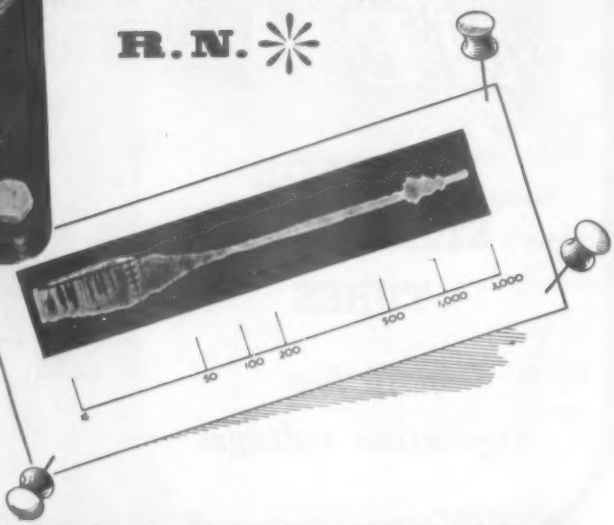
Mullard

MULLARD LTD., COMMUNICATIONS & INDUSTRIAL VALVE DEPT., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2

MVT 150

BRIMAR

Pin down R.N.*



Illustrations by courtesy of Standard Telephones and Cables Limited who say, "These vibrators have been chosen as they give a faithful reproduction of the input wave form and enable high accelerations at any frequency to be obtained."

with GOODMANS VIBRATORS

* RESONANCE NOISE describes a particular factor in a valve which can very seriously impair its otherwise good characteristics. Only when "R.N." is negligible can a valve operate strictly according to its published "curve" and data.

Complete investigation of this phenomenon is only possible by subjecting the valve to *controlled* vibration throughout a wide frequency range. If the valve is operated in a Class A circuit, and the A.C. noise voltage appearing at the anode of the valve is presented on an oscilloscope, a resonance diagram against input frequency can be obtained. By this means it is possible to excite the valve in the range of frequencies 20 to 10,000 c/s, and the resonance noise performance checked. By the use of a twin mounting as illustrated, comparisons of valves can be made under identical conditions.

Just another of the wide applications of Goodmans Vibration Generators. Perhaps "controlled vibration" can serve you also.

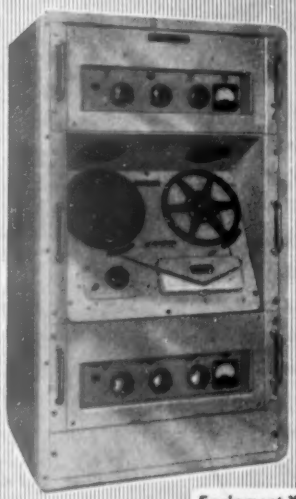
The range includes models developing a force of ± 300 lbs. to the midget model with a force output of ± 2 lbs. for optical-cell research and hairspring torque testing etc. Full technical data available from "Vibration Division W"

GOODMANS INDUSTRIES LIMITED
AXIOM WORKS, WEMBLEY, MIDDX.
Phone: WEMbley 1200 (8 lines)

GD

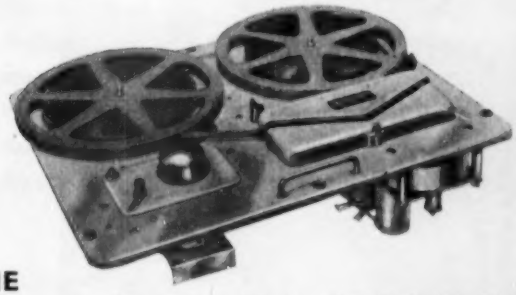
Ferrograph 2A

Ferrograph Model YD



Equipment YDC

A COMMON factor in UNCOMMON PERFORMANCE



THE WEARITE TAPEDECK

The reputation of the 'Tapedeck' is so well-known and so firmly established as to call for no extravagance in describing its many virtues. Indeed, it forms the basis of the recorder instruments in common use in the Defence Services of the United Kingdom and many other countries, as well as being the choice of broadcasting Authorities throughout the World.

FERROGRAPH 2A A reasonably inexpensive instrument approaching professional standards with a specification commending it to those engaged in educational and cultural pursuits.

FERROGRAPH MODEL YD A triple-speed instrument designed mainly for use in the scientific and industrial fields. Principally intended for operation from and into 600 ohm lines, a high gain stage has been provided, however, to allow for recording direct from normal microphones.

EQUIPMENT YDC A simultaneous dual-channel Recorder-Reproducer offering special facilities for analytical research into medical, aeronautical and scientific problems. Any two activities capable of translation into electrical phenomena within the frequency and phase shift limitations can be recorded and replayed simultaneously.

Originators of Tapedecks

WRIGHT & WEAIRE LTD

131 SLOANE ST., LONDON, S.W.1

Phone : SLOane 2214/5 & 1510

Advance
audio signal generator

COVERS
15 c/s TO 50,000 c/s

ACCURACY
PLUS/MINUS 2%
PLUS/MINUS 1 c/s

LOW DISTORTION

1 WATT OUTPUT
INTO 600 OHMS
OVER ENTIRE
RANGE

THE TYPE "J.1."

This model completely covers the wide range of 15 c/s to 50,000 c/s in three ranges, with an accuracy of ± (2% + 1 c/s). Output (continuously variable) into 600 ohms, 0·1 mW.–1W (0·25 – 25 v) ± 2 db, the output impedance approxim-ating to 600 ohms over the whole range. Max. output into 5 ohms is greater than ½ watt. A 20 db attenuator may be switched into use when a very accurate output impedance is required. The total harmonic and hum content as compared with fundamental above 100 c/s is better than 34 db down (2%) at full output, and better than 40 db down (1%) at 0·1 watt. Weight 20 lb. Size 13½" x 10½" x 8½"

Full technical data on leaflet W/17

LIST PRICE (IN U.K.)
£35 : 12s.

The Type 'J2' similar to the Type 'J1,' but with output voltage meter.
LIST PRICE (IN U.K.) £45

ADVANCE CONPONENTS LIMITED · MARLOWE ROAD · WALTHAMSTOW · LONDON · E.17
'Phone: LARkswood 4366/7/8. 'Grams: Attenuate, Walt, London.

PROFIT...

BY EXPERIENCE

Your dealer's experience tells him that a satisfied customer is a profitable customer. That is why all dealers naturally prefer to sell products of high performance and reliability. And that is why they use MULLARD VALVES for replacement. Backed by over 30 years of valve making experience, Mullard Valves have the finest reputation for consistent quality and performance.

there is over 30 years' experience behind the Mullard PL81.

PROFIT BY THE EXPERIENCE OF THIS SERVICE ENGINEER

Mr. S. Seal, Service Manager of T. A. Berry Ltd., Radio and Electrical Dealers of Ewell, Surrey, says:

"I use Mullard replacements because many years of experience have taught me that I can depend on them for consistent performance and reliability."

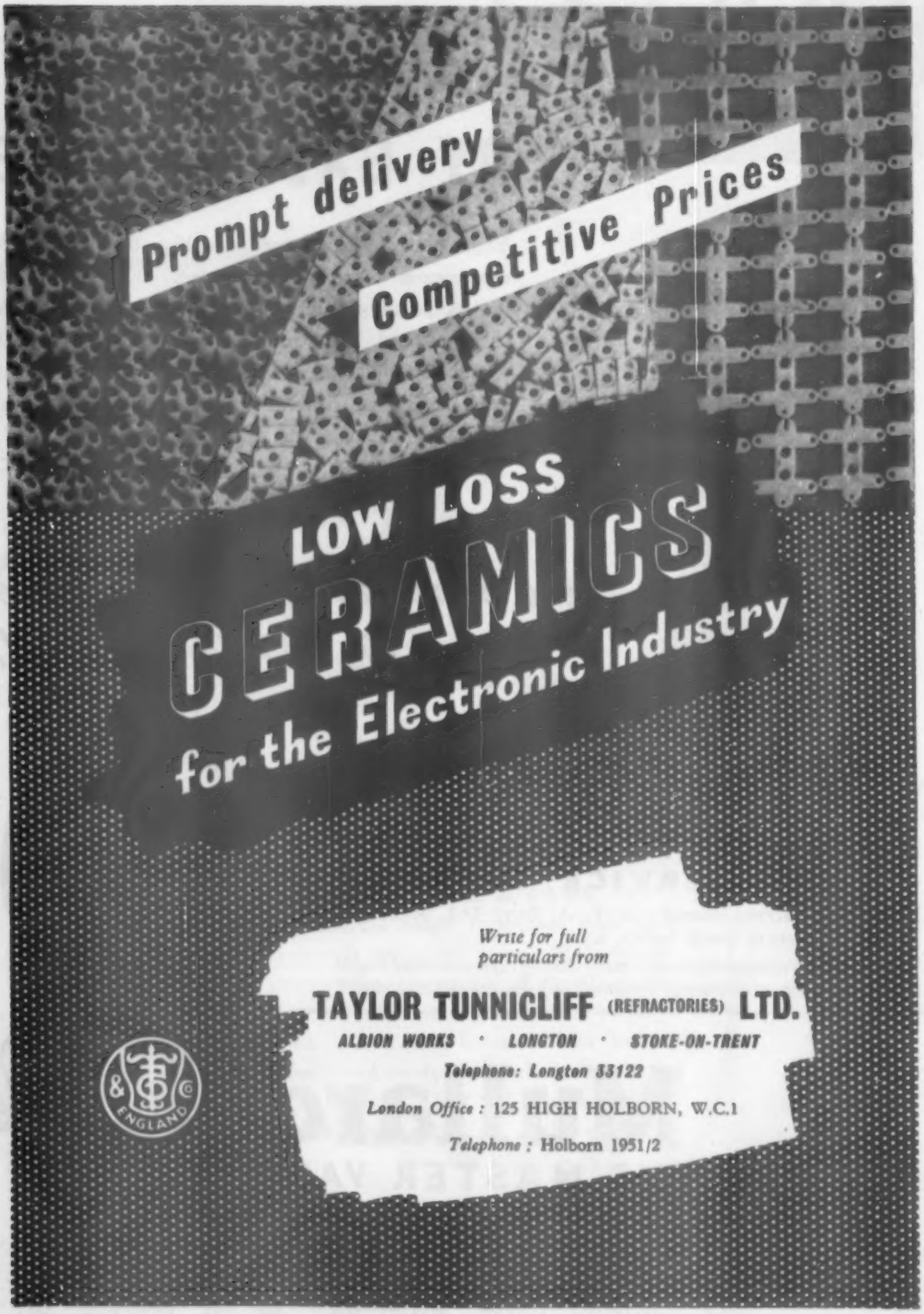
Mullard

THE MASTER VALVE

BLACKBURN, WANDSWORTH, MITCHAM, LYTHAM ST. ANNES
WHYTELEAFE, FLEETWOOD, GILLINGHAM, HOVE, WADDON, RAWTENSTALL

MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2

MVM 1798

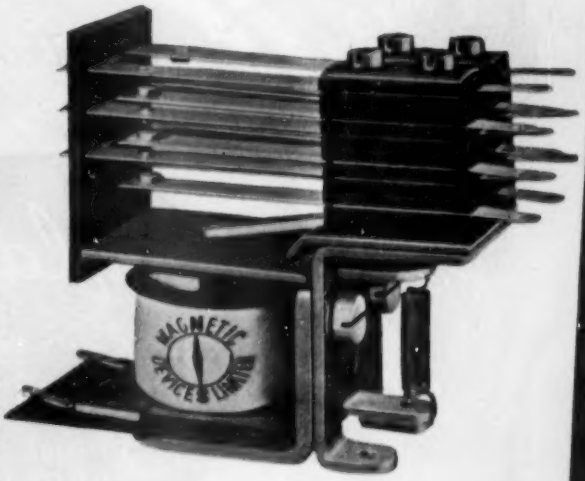

Prompt delivery
Competitive Prices
LOW LOSS
CERAMICS
for the Electronic Industry
Write for full particulars from
TAYLOR TUNNICLIFF (REFRACTORIES) LTD.
ALBION WORKS · LONGTON · STOKE-ON-TRENT
Telephone: Longton 33122
London Office: 125 HIGH HOLBORN, W.C.1
Telephone: Holborn 1951/2
ENGLAND

RELAYS

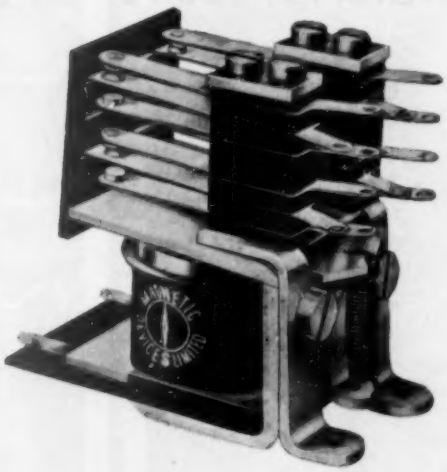
TWO GENERAL PURPOSE TYPES

SERIES 100
A.C. OPERATED

SERIES 105
D.C. OPERATED



An extremely sturdy general purpose relay, which is available in a range of contact combinations from 1 pole normally open to 4 pole changeover, and 6 pole normally open, with a maximum contact rating of 10 amps 250v A.C. Normal power consumption is 3 watts, which can be reduced for the smaller contact assemblies if required. Vacuum impregnated coils can be supplied for tropical or humid conditions.



SERIES 600
A.C. OPERATED

SERIES 605
D.C. OPERATED

This relay is similar to the Series 100/105 and has been specifically designed for light duty applications. Featuring sturdy and extremely compact blade assemblies from 1 pole normally open to 4 pole changeover, and 6 pole normally open. The contacts will carry 5 amps at 250v A.C. Following the usual practice all contact connections are conveniently grouped at one end, and coils can be wound for either current or voltage operation to requirement. Vacuum impregnated coils if specified.

PHONE: NEWMARKET 3181-2-3. TELEGRAMS: MAGNETIC NEWMARKET.

MAGNETIC DEVICES LTD
NEWMARKET

M.D.2A

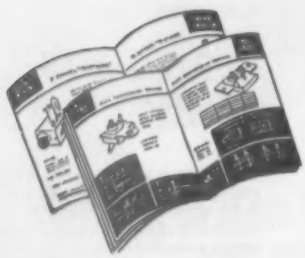
Leading DESIGNERS & USERS of Electronic Equipment

SPECIFY

Cyldon Variable Capacitors and INDUCTANCE TUNERS

for

PRECISION, STABILITY, LONG LIFE



● "Cyldon" Capacitors have a world-wide reputation for efficiency and dependability. We welcome enquiries for types not covered by our standard range. Our resources and experience are at your service.

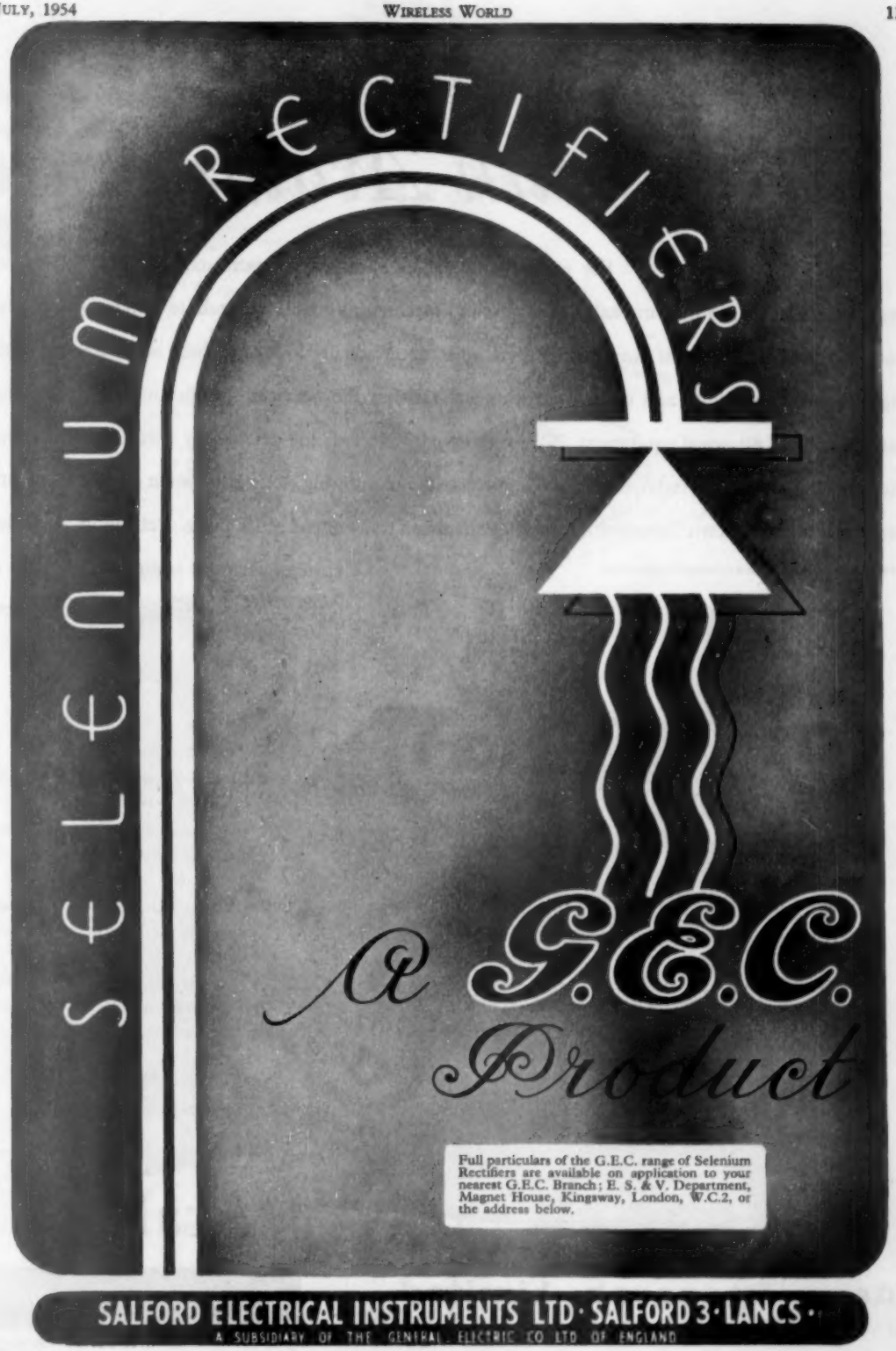
Equipment Manufacturers and Wholesalers are invited to write for literature covering Cyldon "Teletuners" (Ref. T.V. 1953) and Cyldon Trimmers (Ref. T. 1951), together with details of our complete range of Variable Capacitors and list of Agents for Home and Overseas.

SYDNEY. S. BIRD & SONS. LTD

Contractors to Ministry of Supply, Post Office, and other H.M. Government Depts.

CAMBRIDGE ARTERIAL RD., ENFIELD, MIDDX.

Telephone: Enfield 2071-2.
Telegrams: "Capacity, Enfield"


SELENIUM RECTIFIERS
A G.E.C.
Product
Full particulars of the G.E.C. range of Selenium Rectifiers are available on application to your nearest G.E.C. Branch; E. S. & V. Department, Magnet House, Kingsway, London, W.C.2, or the address below.
SALFORD ELECTRICAL INSTRUMENTS LTD · SALFORD 3 · LANCS ·
A SUBSIDIARY OF THE GENERAL ELECTRIC CO LTD OF ENGLAND

Potted *with 'Araldite'*

For potting and sealing electrical components, 'Araldite' is without equal. In addition to its remarkable electrical and mechanical qualities, 'Araldite' offers outstanding adhesion to metals, whilst shrinkage on setting is exceptionally low. 'Araldite' is resistant to high temperatures, humidity and corrosive agents and satisfies the Services specification for the sealing and potting of electrical equipment. This new epoxy resin is being extensively used for potting and sealing components for radio, electronics and electrical engineering. Our illustration shows an inductance and mica dielectric capacitor network for shaping a transmitted radar pulse. Potting in 'Araldite' ensures hermetic sealing and permits a reduction in size and weight.

Photo by courtesy of Telegraph Condenser Company Ltd.

These are the new Epoxies!

'Araldite' (regd.) epoxy resins are obtainable in the following forms:—

- *Hot and cold setting adhesives for metals and most other materials in common use.*
- *Casting Resins for the electrical, mechanical and chemical engineering industries.*
- *Surface Coating Resins for the paint industry and for the protection of metal surfaces.*

Full details will be sent gladly on request.

Aero Research Limited

A Ciba Company, DUXFORD, CAMBRIDGE. Telephone: Sawston 187

'Araldite'

epoxy casting resins

264-65

50 Watt VHF FIXED STATION

The new Pye 50 watt V.H.F. FIXED STATION is of an advanced design employing the latest techniques. It is ideal for use in normal fixed and mobile schemes where high powered transmitters are required and may also be used for point-to-point radio-telephone links.

A further application is in the aeronautical band where the 50 watt transmitter, together with the standard Pye fixed receiver, provides one of the most efficient ground-to-air control stations at present available in the world.

Telecommunications

Pye (New Zealand), Ltd., P.O. Box 2839, Auckland C.1, New Zealand.

Pye Canada, Ltd., Ajax, Ontario, Canada.

Pye-Electronic Pty. Ltd., 65 Park Street, Abbotsford, Melbourne, Victoria, Australia.

Pye Ireland, Ltd., Manor Works, Dundrum, Dublin, Eire.

Pye Radio & Television (Pty.) Ltd., P.O. Box 10648, Johannesburg, South Africa.

PYE LIMITED • • CAMBRIDGE • • ENGLAND

Letter from AMERICA

From . . . C.H.S.,
Palo Alto,
California,
U.S.A.

April 1, 1954

Dear Mr. Briggs,

I do not often feel impelled by the purchase of a new product to write its manufacturer soon thereafter, offering an opinion. But after enjoying my new Super 12/CS/AL for a few weeks only, I cannot repress the thanks I have many times felt for the superb quality designed and built into your product.

I listened, in fact, to virtually every 12 and 15 inch speaker made over here; though, since A-B test facilities are very limited out this way, had to make most of my comparisons, between concerts, with what I could recall of "live" symphony performances, and their instruments. For less than double a Super-12's cost, I could find no one whose accuracy of reproduction, and freedom from distortion, appeared fairly comparable with the Wharfedale.

Because I am interested in reasons behind such performance, your little book, and articles in "High Fidelity," were of considerably more help than contributions from any other source.

I have learned that your production, from choice, is somewhat more limited. Which explains, in great part, why it took me over eight months of searching, through the Los Angeles and San Francisco areas, and by mail, to find a Super-12. I am very glad that I waited.

The only possible criticism that I could offer—tempered by realisation that there are other markets than America—stems from the English standard for bolt-hole locations. I was unprepared for this, had to re-model my enclosure to get the speaker in. But again, it was well worth it.

My thanks and warm congratulations to you, Sir, and your associates, for taking time to do a job so well.

Sincerely yours,
C.H.S.

SOUND REPRODUCTION
by G. A. Briggs.
Enlarged and revised 3rd Edition. 368 pages, 315 illustrations.
17/6 (*plus* 1/- *postage*). *De Luxe edition* 25/- (*plus* 1/- *for postage*).

LOUDSPEAKERS *By G. A. Briggs.*
3rd Edition. 9th Impression. 88 pages, 36 illustrations.
7/6 (*plus* 3d. *postage*).

PIANOS, PIANISTS and SONICS
by G. A. Briggs.
192 Pages. 162 illustrations.
10/6 (*plus* 6d. *postage*).
Sold by booksellers and leading radio dealers. Published by Wharfedale Wireless Works Ltd.

AMPLIFIERS
by G. A. Briggs & H. H. Garner.
First Edition 10,000 copies now sold out.

SUPER 12/CS/AL
£17. 10. 0 TAX FREE

Alcomax III Magnet.
Flux density 17,000 lines on 1¾" centre pole.
Total Flux 190,000 lines.

SINGLE SPEAKER SUPREMACY

The Super 12/CS/AL speaker is fitted with aluminium voice coil, special cone with bakelised apex, and radial corrugations, plus the undoubted advantage of cloth suspension. This assembly, with the extremely high flux density, results in excellent transient response and sensitivity with a very wide frequency range.
Since the introduction of this model some three years ago, the world-wide demand has always exceeded the supply. Delivery can now be effected in 3-4 weeks on the Home Market.

Wharfedale
WIRELESS WORKS LTD.
BRADFORD RD., IDLE, BRADFORD, YORKS.
'Phone : Idle 1235/6. 'Grams : Wharfdel Idle, Bradford.

T/V DOWNLEADS

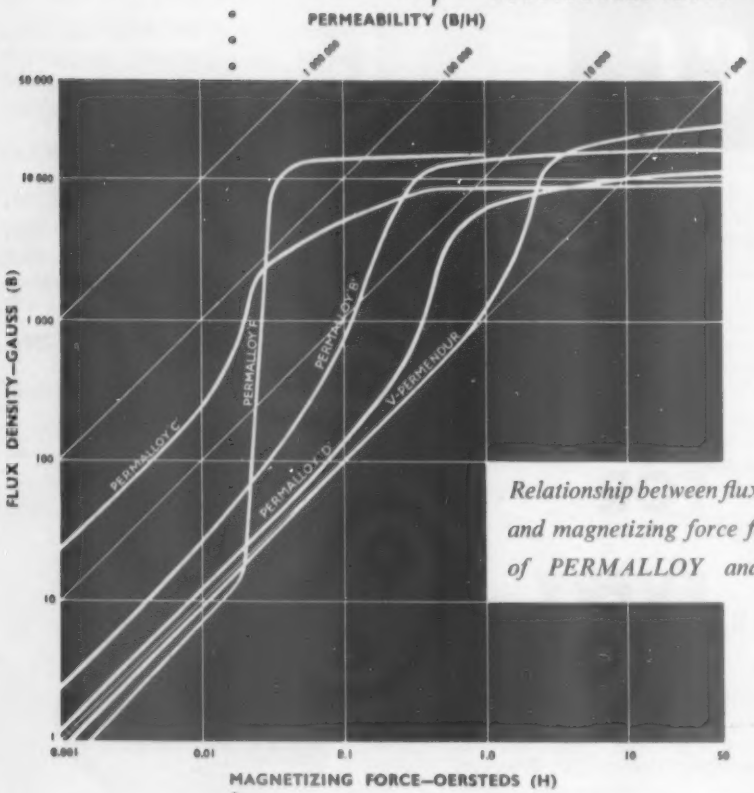
BICC

HAVE
A TYPE
FOR
EVERY
INSTALLATION

WRITE TO-DAY FOR PUBLICATION
No. 244 GIVING FULL PARTICULARS

BRITISH INSULATED CALLENDER'S CABLES LIMITED
21 BLOOMSBURY ST., LONDON. W.C.1. MUS. 1600

Standard magnetic alloys *for* component designs *of* maximum efficiency



Relationship between flux density, permeability and magnetizing force for the various grades of PERMALLOY and V-PERMENDUR.

HIGH quality and consistency, backed by first-class service, are important features in this range of *Standard* magnetic alloys. As large-scale users of Permalloys in communication, electronics and other fields, *Standard* enjoy the unique advantage of observing these alloys under normal working conditions, a factor which has played an important part in their development.

Please ask for further particulars.

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2

TELEPHONE LINE DIVISION: North Woolwich, London, E.16

PROGRESS

in Counting ~

through the ages

HISTORICAL ILLUSTRATIONS BY COURTESY OF THE SCIENCE MUSEUM LONDON.

ROMAN ABACUS

Known to have been in use at the time of Julius Caesar. A surviving specimen is preserved in La Bibliothèque Nationale, Paris.

NAPIER'S BONES

Devised in 1617 by John Napier, a Scottish nobleman, as a mechanical means of multiplication by addition.

Cold Cathode Tubes

FOR

Modern

COUNTING · CALCULATING
SELECTING · SWITCHING

LEIBNITZ'S STEPPED RECKONER

Invented in 1694 by the German philosopher and incorporated in the earliest practicable calculating machines

ODHNER'S WHEEL

A principle first evolved by a Swedish engineer about 1890 and still being applied in present day mechanical calculating machines

THE [illegible] VALVE

HIVAC COLD CATHODE TUBES

The most modern devices for use in electronic systems.

Hivac Limited

GREENHILL CRESCENT, HARROW-ON-THE-HILL
MIDDLESEX, ENGLAND

Phone: HARrow 2655 *Cables: Hivac, Harrow*

HIVAC Cold Cathode Tubes — Miniature and Subminiature Valves — Electrometer Valves — Neon Indicator Lamps — Telephone Switchboard Lamps — are used by the world's leading manufacturers.

★ ★ ★ ASSOCIATED ILIFFE TECHNICAL BOOKS ★ ★ ★

A complete list of Iliffe Technical Books on Radio and Television will be sent free on application to the address below.

SOUND RECORDING AND REPRODUCTION

By J. W. Godfrey and S. W. Amos, B.SC., (HONS.) A.M.I.E.E., in collaboration with the B.B.C. Engineering Division. This book has been written primarily as an instruction manual for the B.B.C. engineering staff but will prove invaluable to all interested in the theory and practice of disc, magnetic and film recording. Special reference is made to equipment used by the B.B.C., and a number of appendices contains a generous amount of reference information not readily available elsewhere.

30s. net. By post 30s. 8d.

ADVANCED THEORY OF WAVEGUIDES

By L. Lewin. Sets out the various methods that have been found successful in treating waveguide problems—the author selecting for discussion a number of topics as representative of the field in which the centimetre-wave engineer is now engaged. Many of these examples are concerned with the rectangular waveguide, but the reader will be able to apply the general principle to most of the cases encountered in practice.

30s. net. By post 30s. 7d.

TELEVISION RECEIVING EQUIPMENT

By W. T. Cocking, M.I.E.E. 3rd Edition. Explains the fundamental principles involved and then describes each stage of the normal television receiver. The text includes notes on special circuits and gives practical details of receiver design. Other chapters are devoted to faults and their remedies, servicing of modern sets and the problems of obtaining selectivity. Mathematical data of particular value to the designer have been collated and appear in appendices.

18s. net. By post 18s. 8d.

MICROPHONES

By the Staff of the Engineering Training Dept., B.B.C.

This new book, originally written as a textbook for use in training B.B.C. engineers, has now been made available for general publication. It first discusses the requirements for microphones in a broadcasting studio and sets out the laws relating to sound waves and their behaviour. The design and characteristics of various types of microphone are then described, and full details given of the ribbon, moving-coil, crystal and condenser instruments used in B.B.C. studios during recent years.

15s. net. By post 15s. 5d.

SHORT WAVE RADIO AND THE IONOSPHERE

By T. W. Bennington (Engineering Division, B.B.C.). 2nd Edition. Shows how existing ionospheric data can be applied to everyday problems of short-wave transmission and reception. A new edition of the work, first published six years ago under the title " Radio Waves and the Ionosphere," this is to all intents and purposes an entirely new book. It has been completely re-written, re-set in a new type, and 56 new illustrations have been added. 8½in. x 5½in. 138 pp. 61 illustrations.

10s. 6d. net. By post 10s. 10d.

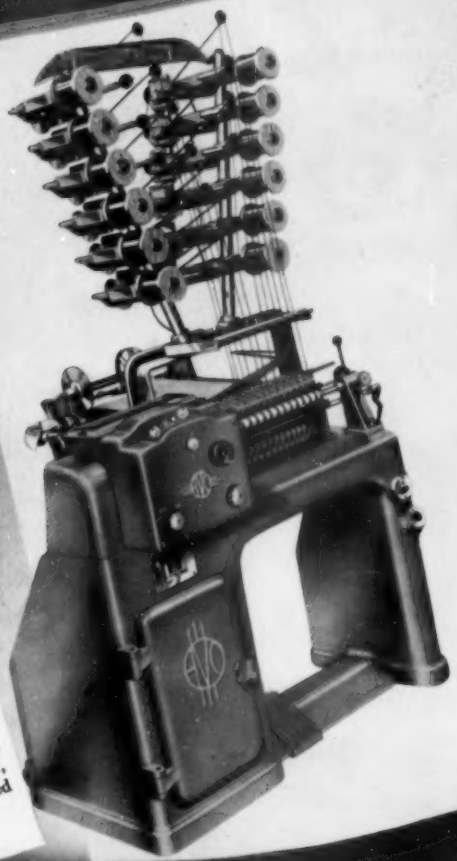
Published for 'Wireless World' and obtainable from all booksellers or by post from :—

ILIFFE & SONS LTD., DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

DOUGLAS MACADIE

Automatic

COIL WINDERS



This typical page from our complete Catalogue shows the "Douglas" Fully Automatic Multi-Winder, designed for the high speed production of large quantities of coils with or without paper interleaving.

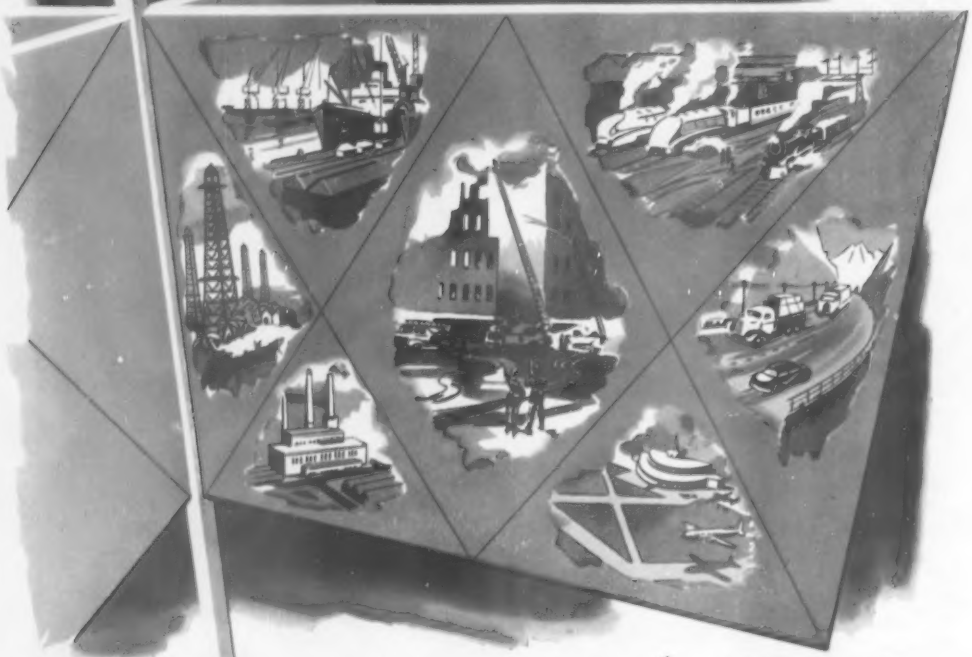
Our standard range includes 27 different Machines, and we make a number of other types designed for special purposes. Long experience in the design and manufacture of Coil Winders invests our machines with an unexcelled standard of efficiency and ensures maximum economy in the production of windings for every industrial requirement. Our revised Catalogue is now in course of preparation and a copy, when ready, will be sent to interested executives on application.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.

WINDER HOUSE · DOUGLAS STREET · LONDON S.W.1 *Telephone:* VICtoria 3404—9

G.E.C.

RADIO COMMUNICATION EQUIPMENT



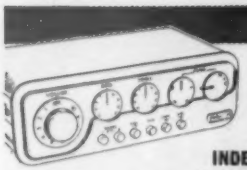
for use in all parts of the **WORLD**

G.E.C. radio equipment for H.F. and V.H.F. communication has been developed with two important advantages from the purchaser's point of view constantly in mind. *Suitability for the exact operational need and reliability.* These advantages are entirely due to the long and valuable experience of the G.E.C. in all branches of radio engineering, backed by its unique research organisation.

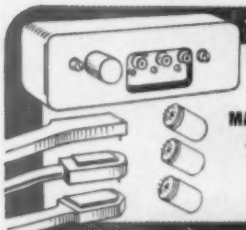
Equipment is available for every kind of radio communication requirement — police, ambulance and fire services, aircraft, shipping, etc. The general purpose receiver shown here is the BRT400D, built to meet the most exacting needs of commercial service in all parts of the world, providing high grade telegraphy service and quality reception for re-broadcast.

THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

The best which present techniques can devise . . .

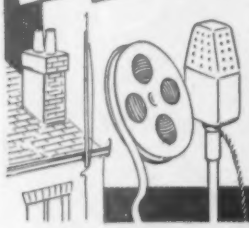


UNIQUE FILTERING SYSTEM INDEPENDENT OF MUSICAL BALANCE

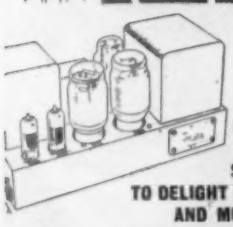


CORRECT MATCHING FOR ANY PICK-UP BY PLUG-IN UNITS

CORRECT EQUALISATION FOR EVERY RECORDING



INPUTS FOR RADIOS TAPE MIC. ETC. VIRTUALLY MADE TO MEASURE



A POWER AMPLIFIER WITH PERFORMANCE STABILITY SPECIFICATION TO DELIGHT THE ENGINEER AND MUSICIAN ALIKE

Like its predecessor, the QUAD II embodies outstanding features anticipating trends in both amplifier and associated equipment design. The importance of these features will be apparent to all who have followed the growth of high quality reproduction in recent years.

The criterion, as always, is that the reproduced sound shall be the closest approach to the original—that the enjoyment and appreciation of music may be unimpeded. This is reflected throughout the electrical and mechanical design. It is reflected, too, in the straightforward and logical system of control, achieved without the sacrifice of a single refinement or adjustment capable of contributing to the final objective.

The QUAD II for convenience of installation, is constructed in two units—the main amplifier and the control unit. Each is complementary to the other, offering in complete form the best which present techniques can devise.

ACOUSTICAL MANUFACTURING CO LTD

ACOUSTICAL MANUFACTURING CO. LTD., HUNTINGDON, ENGLAND

MAGNETIC MATERIALS Extensive research and manufacturing facilities have established Mullard as the leading producers of magnetic materials. They were the first, for example, to introduce Ferroxcube, the world's most efficient magnetic ferrite; 'Ticonal' anisotropic permanent magnets, renowned for their high stability and high energy output; and Magnadur, an entirely new type of permanent magnet with the insulating properties of a ceramic.

The wealth of experience gained from these developments is available to all users of magnetic materials through the Mullard advisory service. An enquiry to the address below will put a team of specialised engineers at your disposal.

Mullard

Mullard

'TICONAL' PERMANENT MAGNETS · MAGNADUR (Formerly Ferroxdure) PERMANENT MAGNETS · FERROXCUBE MAGNETIC CORE MATERIAL

MULLARD LTD., COMPONENT DIVISION, CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2.

Mullard Magnadur permanent magnets ready for firing.

Life line of communication . . .

Marconi's fitted the first ship with wireless and by 1907 200 ships and more than 100 shore stations had been equipped. Today practically every vessel that ventures on the high seas carries wireless. All radio approach and marker beacons around the British Isles have been designed and manufactured by Marconi. The mariner is warned of hazards and guided into safe channels by Marconi equipment in nearly every principal shipping lane of the world.

MARINE BEACONS AND NAVIGATIONAL AIDS

MARCONI

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED · CHELMSFORD · ESSEX

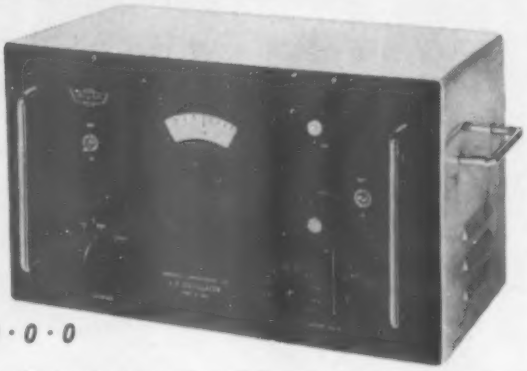
LG 2

A NEW WIDE-BAND A.F. OSCILLATOR that really "gets down to it"....(1·4 CYCLES)

TYPE G.420. This Furzehill instrument delivers a constant sinusoidal output of up to 1 volt into 600 ohms over the wide frequency range of 1.4 c/s. to 15 kc/s.

Frequency Range: 1.4 to 15 c/s. 14 to 150 c/s. 140 c/s. to 1.5 kc/s. 1.4 kc/s. to 15 kc/s. Accuracy 2.5%. Scale arc 280°.
Output: 1 V r.m.s. into 600 ohms or 10 V r.m.s. into high impedance, substantially constant over entire frequency range.
Attenuator: 600 ohm, continuously variable, T-pad.
Harmonic Content: Less than 2% over most of the range.
Hum Level: Better than 40 dB below any signal level.
Stability: Less than 0.1 dB change in output volts and less than 0.1% change in frequency for 10% change in supply voltage.
Delivery: 7/14 days.

NOTE:—This instrument is also available to the above specification, but including the addition of square wave output at a small additional charge, (Type G.420A).
Write for full particulars of this and other Laboratory instruments to:—



Furzehill

Price, Ex-Works: £50 · 0 · 0

AN UNUSUALLY LOW PRICE FOR AN UNUSUALLY VERSATILE PERFORMANCE

Furzehill Laboratories Ltd.

SHENLEY ROAD · BOREHAM WOOD · HERTS. Cables: FURZLAB, LONDON. Tel.: ELStree 3940.

VIBRATION TESTING ?

No, we do *not* recommend this method! We offer, instead, SAVAGE 'VLF' and 'LRF' Amplifiers, giving

A SOURCE OF POWER

where it is required for vibration and fatigue testing of structures, components, engineering products, engines, special metals, etc. In this direction, the applications of this equipment are countless, as they are, also, as a *variable frequency power source* for transformers, meters, motors and electrical component design.

This equipment is inexpensive to purchase, simple and economical to use; gives complete and accurate control at all times.

Ask us TO-DAY for full details, without obligation. Or let us know your problem in this field and we will gladly help you.

Leading organisations now using this equipment include: Bristol Aeroplane Co.; The Brush Electrical Engineering Co., Ltd.; English Electric Co., Ltd.; Ferranti Ltd.; G.E.C.; Handley Page Ltd.; The Imperial College of Science; Siemens Bros. & Co., Ltd.; S.T.C.; Vickers-Armstrongs; R.A.F., Farnborough, etc.

OUTPUTS

100 watts 'VLF'
3 c/s to 6 c/s

1000 watts 'VLF'
6 c/s to 2000 c/s

MARK II STAR
50 c/s to 10 Kc/s

'LRF'
5 Kc/s to 100 Kc/s

W. BRYAN Savage

V.L.F & L.R.F AMPLIFIERS

VERY LOW FREQUENCY — LOW RADIO FREQUENCY

W. BRYAN SAVAGE LTD.
WESTMORELAND RD., LONDON, N.W.9
TELEPHONE: COLINDALE 7131

. . . LOUDSPEAKERS

These loudspeakers have been designed to provide minimum magnetic interference together with high acoustic efficiency. ELAC Elliptical and round loudspeakers are used in most of the leading Television and Radio receivers.

PRICES INCLUDING P.T. FOR LOUDSPEAKERS LESS TRANSFORMER.

7" × 4" Elliptical	Flux 6,500 Gauss	**21/6**	6½" PM. 6G	Flux 6,500 Gauss	**21/6**
3½" PM. 3G	Flux 6,500 Gauss	**18/7**	8" PM. 8D	Flux 7,500 Gauss	**28/6**
5" PM. 5G	Flux 6,500 Gauss	**20/-**	10" PM. 10D	Flux 7,500 Gauss	**31/8**

ELAC

ELECTRO ACOUSTIC INDUSTRIES LTD.

Stamford Works, Broad Lane, Tottenham, N.15.

A Clever Idea!!

TRUVOX

RADIO JACK

Extend the application of, and get greater enjoyment from, your Tape Recorder with the TRUVOX "Radio Jack" . . designed to give you direct reception from either of two local stations (at the flick of a switch) or to make recordings, for future playback, of any of the programmes radiated by the selected stations. Housed in a cast case, jewel gold-hammered finish ; extremely simple to use and attractive in appearance. The "Radio Jack" can be used also with any amplifier having a high impedance microphone input jack. Connection to your instrument is simplicity itself . . . just plug it in by means of the BSS standard two-pole telephone jack which is an integral part of the design of this unique unit. It is only a 2¼in. cube, with an overall length of 4¼in.

PRICE **£2.18.6**

(PLUS 21/5d. PURCHASE TAX)

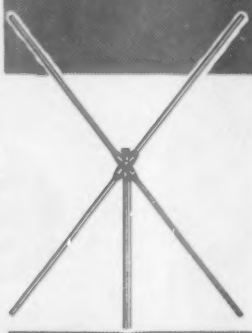
Send now for full details to

TRUVOX LIMITED

HARROW · MIDDLESEX

Sales Office : 15 Lyon Road, Harrow, Middlesex. *Telephone : Harrow 9282*
Technical & Service Depts. : 328 The Broadway, Station Road, Harrow. *Telephone : Harrow 4455*

The Famous UNEX TELEVISION AERIAL IS NOW ONLY 74/6



BAND III

Aerials and downleads will be equally important for Band III reception—we design and manufacture both *aerials and cables*—so order Aerialite when the time comes.

The popularity of the Unex has resulted in increased production which has enabled us to reduce the prices substantially. The outstanding features of the Unex are :—

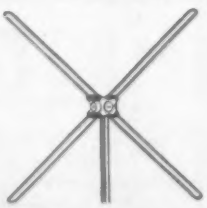
- **Easy fitting.**
- **Robust construction**
- **100% waterproofing.**
- **3 dB forward gain.**
- **Light weight.**

Unex 83S, complete with 6ft. alloy mast, chimney bracket, etc..... £3 14 6
Unex 83X array only..... £2 0 0
Unex 83T, complete with 10ft. x 2in. alloy mast, brackets, etc..... £6 15 0
Unex 83F, complete with 14ft. x 2in. alloy mast, brackets, etc..... £7 12 6
Unex 83C, with cranked arm, chimney brackets, etc. £3 14 6

Above prices are for all vertical channels and 2/6 extra for horizontal channels

The DUBLEX
High Grade Aerial

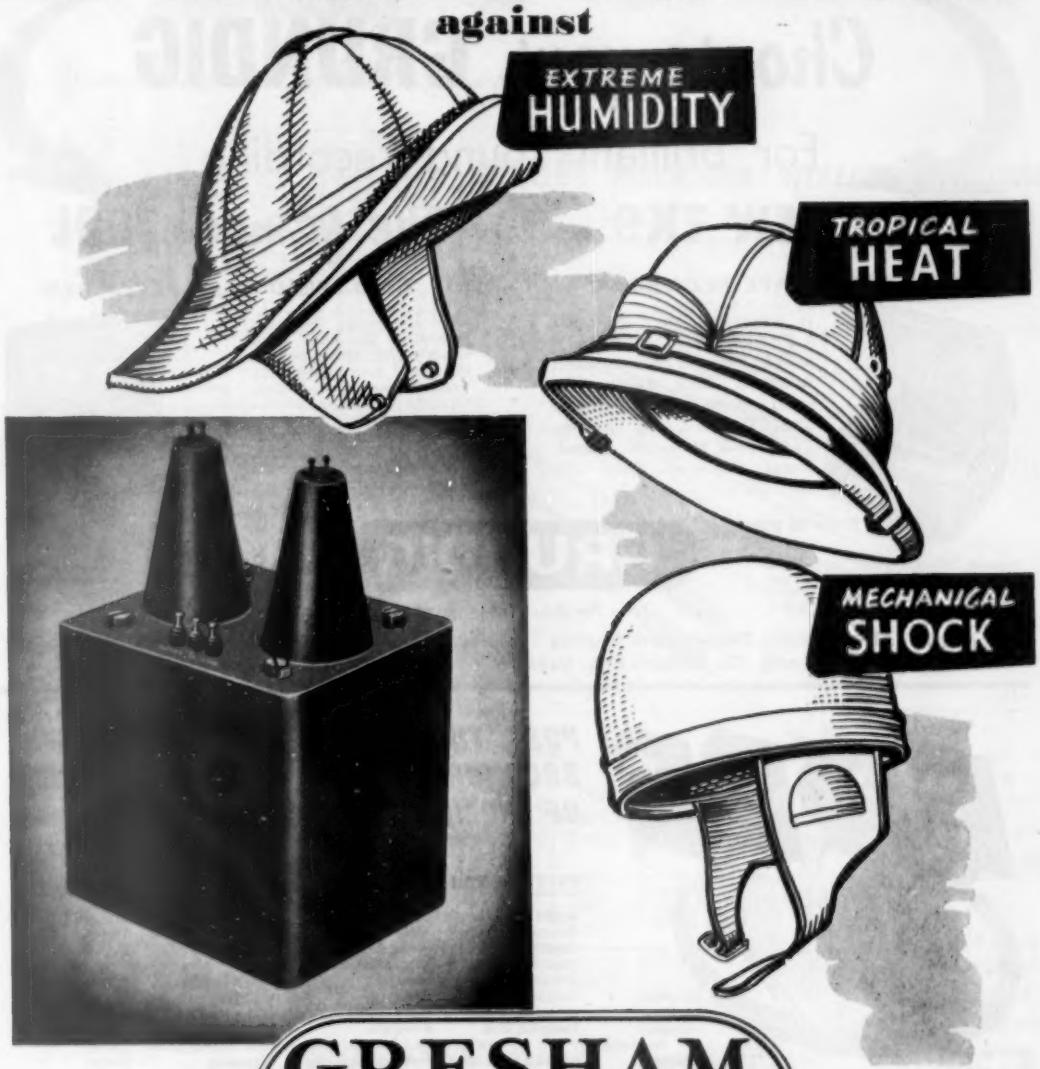
The Dublex has the highest gain (6 dB) of any aerial in the same price bracket. It has particularly strong mechanical construction with special resilient mountings to prevent element breakage. The Dublex is available with cranked, 7ft., 10ft. or 14ft. chimney mounting masts and brackets.
Dublex 77S, complete with 7ft. mast, brackets, etc. £4 8 6



Aerialite LTD.

CASTLE WORKS STALYBRIDGE CHESHIRE.

For MAXIMUM PROTECTION against



GRESHAM TRANSFORMERS

LEOCAST (RESIN ENCAPSULATED)

Supplied with 'C' Cores to RCL 215 dimensions or with Standard Laminations to RCL 216 dimensions, Leocast Transformers have been satisfactorily tested to the standard required by RCS 214 (Grade S) to Humidity Class H.1. The dielectric qualities of the resins used make Leocast Transformers particularly suitable for high-voltage applications.

GRESHAM TRANSFORMERS LTD., TWICKENHAM ROAD, HANWORTH, MIDDX. *FELtham 2271-4*

Choose your GRUNDIG

For brilliant sound recording

The NEW TK9

SINGLE-SPEED TAPE RECORDER

A masterpiece of compactness and engineering. Unique features include: Precision Place Indicator, Automatic Track Switch, Universal Magic Eye, Automatic Stop. Recording time 1¼ hours. Tape speed 3¾ in. per second. Sound Frequency Range 50-9,000 c/s.

Price 65 gns.
less microphone

Grundig "Golden Voice" moving coil microphone (GDM.5) - - - 6 gns.
Grundig "Silver Voice" crystal microphone (GXM. 1) - - - 4½ gns.

The famous 700L

TWO-SPEED TAPE RECORDER

Used by leading musicians throughout the world. Two hours perfect speech recording or one hour high-fidelity music recording. Unique Grundig *condenser* microphone—as sensitive as the human ear. Tape speeds 7½ in. and 3¾ in. per second. Sound Frequency Range 50-10,000 c/s and 50-6,000 c/s.

Price 80 gns.
including condenser microphone

GRUNDIG

Hire Purchase Terms Available

Most Radio and Photographic Dealers stock Grundig. Ask for demonstration or write for illustrated Folder to: Grundig (Gt. Britain) Ltd., Dept. W.W. Kidbrooke Park Road, S.E.3

G137

FREE PROSPECTUS

POST THE COUPON TODAY FOR OUR BROCHURE ON THE LATEST METHODS OF HOME TRAINING FOR OVER 150 CAREERS & HOBBIES

PRIVATE AND INDIVIDUAL TUITION IN YOUR OWN HOME

Accountancy
Advertising
Aeronautical Engineering
Automobile Engineering
Banking
Book-keeping
Building
Business Management
Carpentry
Chemistry
Civil Service
Civil Engineering
Commercial Subjects
Commercial Art & Drawing
Customs & Excise Officer
Draughtsmanship
Economics
Electrical Engineering
Electronics
Fashion Drawing
Heating & Ventilating Eng.
Industrial Administration
Journalism
Languages
Marine Engineering
Mathematics
M.C.A. Licences
Mechanical Engineering
Motor Engineering
Photography
P.M.G. Licences
Police
Production Engineering
Public Speaking
Radar
Radio & Television Servicing
Radio Engineering
Refrigeration
Retail Shop Management
Salesmanship
Sanitation
Secretaryship
Sheet Metal Work
Shorthand & Typing
Short Story Writing
Sound Recording
Structural Eng.
Telecommunications
Television
Time & Motion Study
Tracing
Welding
Works Management
Workshop Practice
and many others.

Also courses for University Degrees, General Certificate of Education, B.Sc.Eng., A.M.I.Mech.E., L.I.O.B., A.C.C.A., A.C.I.S., A.M.Brit.I.R.E., A.M.I.I.A., City & Guilds Examinations, U.S.A. Certificates, etc.

NEW! LEARN THE PRACTICAL WAY

With many courses we supply actual equipment thus combining theory and practice in the correct educational sequence. This equipment, specially prepared and designed remains your property. Courses include: Radio, Television, Mechanics, Electricity, Draughtsmanship, Carpentry, Photography, Commercial Art, etc.

The Advantages of E.M.I. Training ★ The teaching methods are planned to meet modern industrial requirements. ★ We offer training in all subjects which provide lucrative jobs or interesting hobbies. ★ A tutor is personally allotted by name to ensure private and individual tuition. ★ Free advice covering all aspects of training is given to students before and after enrolment with us.

COURSES FROM £1 PER MONTH

EMI INSTITUTES

The only Postal College which is part of a world-wide Industrial Organisation

POST THIS COUPON TODAY

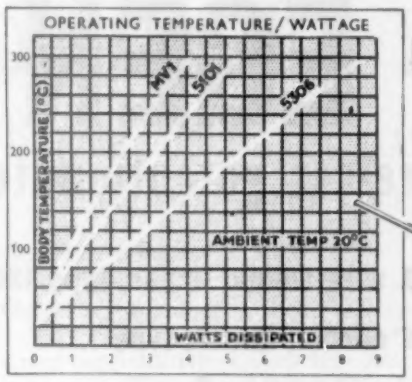
Please send without obligation your FREE book.

E.M.I. INSTITUTES (Dept. 127k)
43 Grove Park Road, London, W.4 Phone: Chiswick 4417/8

NAME .....
ADDRESS .....
.....
.....
SUBJECT(S) OF INTEREST .....
7/54 ICS

PAINTON

By Appointment to the Professional Engineer



MIDGET WIREWOUND VITREOUS RESISTORS

MINIATURE EQUIPMENTS
DEMAND **MIDGET** RESISTORS

Dimensionally
Painton **MIDGET** resistors
offer the MAXIMUM WATTAGE DISSIPATION
MAXIMUM OHMIC RANGE
MAXIMUM SAFETY FACTOR

In the Heavy Duty **MIDGET** Range, the extremely high wattage dissipation is achieved by :
(a) the use of a sintered alumina ceramic former, with thermal conductivity approximating steel (Patent 626128), in conjunction with a Painton glaze developed to match the thermal and mechanical properties of sintered alumina,
(b) the exceptional strength and conductivity of the Painton " Intermediate Wire Process " of resistance termination (Patent 575297).

Range	Type	Resistance Range Ohms		Tol.	Rating Watts		Max. Working Temp.	Temperature Coefficient	DIMENSIONS			
		Min.	Max.		Normal 20 °C.	Tropical 70 °C.			Length	Diam.	Lead Length	Lead Material
Standard	MV1	1 10	9.99 4700	10% 5%	4	3	300 °C.	BELOW 100°— NEGLIGIBLE ABOVE 100°— 0.01% /C.	13/32"	13/64"	1¼"	20 S.W.G. Silver Clad Copper Wire
Heavy Duty	5101	1 10	9.99 4700	10% 5%	5.5	4	350 °C.	BELOW 100°— NEGLIGIBLE ABOVE 100°— 0.01% /C.	13/32"	13/64"	1¼"	
Heavy Duty	5306	10	15,000	5%	8.5	7	350 °C.	BELOW 200°— NEGLIGIBLE ABOVE 200°— 0.01% /C.	13/16"	9/32"	1½"	

PAINTON

Northampton England

ATTENUATORS AND FADERS • STUD SWITCHES • FIXED AND ADJUSTABLE WIREWOUND RESISTORS
WIREWOUND POTENTIOMETERS • MIDGET R.F. CHOKES • HIGH STABILITY CARBON RESISTORS • TERMINALS
PLUGS AND SOCKETS • KNOBS, DIALS AND POINTERS • TOGGLE SWITCHES • PUSH BUTTON SWITCHES

FLEXIBLE SHAFTING for REMOTE CONTROL

POWER DRIVES and COUPLINGS

GENERAL REMOTE CONTROL USES

OPERATING from an accessible point, switches, valves and other electrical and mechanical devices located in remote or inaccessible places. Flexible shafts are readily adapted for either manual or automotive operation of controls.

OPERATING any element requiring rotation or push-pull movement or both, with the controlled element close to or at a distance from the control point. Where an element requires both push-pull and rotation, both actions can be accomplished with a single shaft.

OPERATING indicators and indicating devices of all kinds.

CENTRALIZING operational adjustment and controls of machines and other equipment at a single point convenient to the operator.

PROVIDING controls that free operators from mechanical or electrical hazards.

■ *The S. S. White Company manufactures standard shafts and is prepared to develop special shafts providing sensitive control over long and short distances.*

THE S.S.White CO. OF GREAT BRITAIN LTD. INDUSTRIAL DIVISION

Britannia Works,
St. Pancras Way,
LONDON, N.W.1 *Phone: EUSton 5393*

new

EGEN

pre-set potentiometers

■ **wire-wound linear, type 126**

■ **carbon linear, type 127**

actual size

- *Completely enclosed in high-grade phenolic mouldings, keeping resistance elements dust-free.*
- *Solder tags are heavily silver-plated and designed to withstand soldering heat and bending without loss of rigidity.*
- *Spindles are fully insulated and provided with integral control knobs for finger or screwdriver adjustment.*
- *Tapped for 2-hole 6BA fixing on ½" centres.*

These Egen potentiometers are based on long experience of the needs of television and electronic equipment manufacturers.

EGEN ELECTRIC LTD

CHARFLEET INDUSTRIAL ESTATE · CANVEY ISLAND · ESSEX

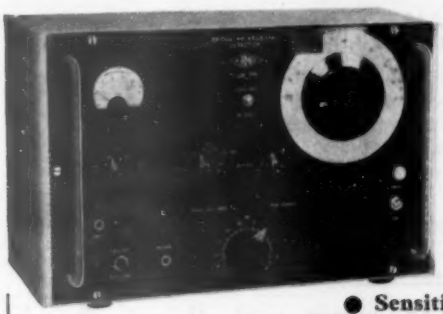
Phone: CANVEY 681 *and* 682

AIRMEC

BRIDGE DETECTORS

BRIDGE OSCILLATOR AND DETECTOR TYPE 703

- **Oscillator Frequency:** 1000 c/s.
- **Oscillator Output:** 100 Milliwatts.
- **Output Impedance:** High 3000 ohms. Low 100 ohms.
- **Amplifier Sensitivity:** Low Impedance: 40 microvolts for 10% f.s.d. High Impedance: 200 microvolts for 10% f.s.d.
- **Indication:** Both meter and phones.
- **Input Impedance:** High, 600 ohms—Low, 50 ohms.
- **Accuracy:** A reading accuracy of 1% is obtainable on bridges using 1000 : 1 ratio arms, and a correspondingly greater accuracy where smaller bridge ratios are employed.
- **Immediate delivery.**



BRIDGE HETERODYNE DETECTOR TYPE 775

- **Frequency Range:** 6.5 to 751 kc/s in four ranges.
- **Beat Frequency:** 1 kc/s.
- **Selectivity:** Not less than 30 db discrimination at 1 kc/s off tune.
- **Indication:** Both meter and phones.
- **Sensitivity:** Readable meter deflection for 5 microvolts input. Audible note in phones for 1 microvolt input.
- **Input Conditions:** Transformer having screened and floating primary winding.
- **Attenuation:** 0 to 60 db in 20 db steps. 0 to 20 db slidewire.
- **Immediate delivery.**

Both instruments, which operate from 100-130 and 200-250 volts 50 c/s mains supply, are enclosed in standard Airmec cases and are therefore suitable both for bench use and forward mounting on a 19 inch rack.

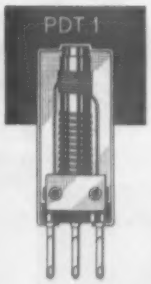
Full details of these or any other Airmec instruments will be forwarded gladly upon request.

AIRMEC LIMITED HIGH WYCOMBE - BUCKINGHAMSHIRE - ENGLAND

Telephone: High Wycombe 2060 *Cables:* Airmec High Wycombe

MAXI-Q F.M. COMPONENTS

REGD.

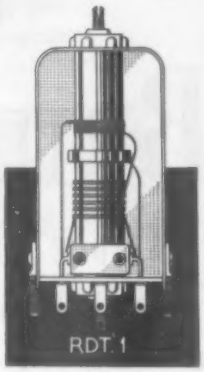


RATIO DISCRIMINATOR TRANSFORMER 10.7 Mc/s. Ref. RDT. 1

A 10.7 Mc/s. transformer for use in ratio discriminator type circuits. Can size 1⅜in. square x 2¼in. high. Secondary winding of bifilar construction. Iron dust core tuning, polystyrene former and silver mica condensers. Price 12/6 each.

PHASE DISCRIMINATOR TRANSFORMER 10.7 Mc/s. Ref. PDT. 1

A miniature 10.7 Mc/s. transformer for use in frequency modulation detector circuits where the limiter/Foster-Seeley type of circuit is employed. Designed for carrier deviation of +75 kc/s. Qk.—1.5. Wound on black bakelite former, complete with iron dust slugs and two 6 B.A. threaded fixing holes on .532in. centres. Screening can: 1⅞in. x 13/16in. square. Price 9/- each.



I.F. TRANSFORMER IFT.11/10.7

A miniature I.F. Transformer of nominal frequency 10.7 Mc/s. The transformer is primarily intended for the I.F. stages of frequency modulation receivers and convertors. The Q of each winding is 90 and the coupling critical. Construction and dimensions as PDT.1. Price 6/- each.

I.F. TRANSFORMER IFT.11/10.7/L

As IFT.11/10.7 but with secondary tap for limiter input circuits. Price 6/- each.

Full constructional details for building an F.M. Feeder unit are given in our TECHNICAL BULLETIN (DTB.8). Price 1/6 each.

Send 9d. for General Catalogue. Obtainable from your nearest stockist or in case of difficulty direct from:

DENCO (CLACTON) LTD. 357/9 Old Road, Clacton-on-Sea, Essex

LONGEST SCALE – SMALLEST SPACE

This compact, robust D.C. Milliammeter is flush mounting and is ideal for use in restricted space.

SCALE LENGTH : 9"

RANGE FROM 0-500 μA

The meter with the dead beat movement

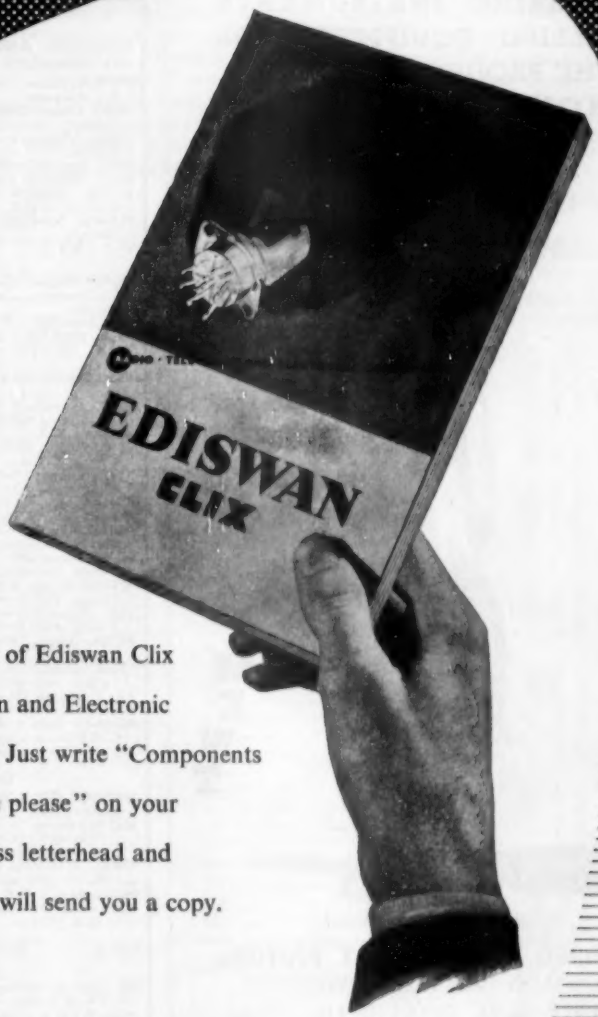
The meter measures only 5" across and the depth behind the panel is only 2" yet it retains a scale length of 9". It is available with spade or knife-edge pointer and special scales can be supplied to customers' specification if required. Send for prices and full details.

BRITISH PHYSICAL LABORATORIES

Radlett, Herts *Tel : Radlett 5674/5/6*

LONDON STOCKIST: M. R. SUPPLIES LTD., 68 NEW OXFORD STREET, LONDON, W.C.1

dm BP.19



MANUFACTURERS OF EQUIPMENT, and DEVELOPMENT GROUPS are invited to send today for this NEW complete catalogue of Ediswan Clix Radio, Television and Electronic Components. Just write "Components Catalogue please" on your business letterhead and we will send you a copy.

EDISWAN

CLIX

RADIO COMPONENTS

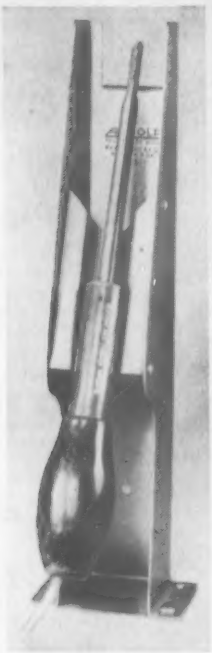
THE EDISON SWAN ELECTRIC COMPANY LIMITED, *Member of the A.E.I. Group of Companies*
155 Charing Cross Road, London, W.C.2 and Branches. *Telephone: Gerrard 8660. Telegrams: Ediswan, Westcent, London.*
C.R.1a Radio Components Sales Office: 21 Bruton Street, London, W.1 *Telephone: Mayfair 5543*

ADCOLA

(Regd. Trade Mark)

SOLDERING INSTRUMENTS & ALLIED EQUIPMENT FOR THE PRODUCTION LINE & HOME CONSTRUCTOR

SOUND JOINTS FOR SOUND EQUIPMENT



$\frac{3}{16}$" Bit

$\frac{1}{8}$" Bit Instrument Model

SUPPLIED IN ALL VOLT RANGES

STANDARD VOLTAGES STOCKED

6/7, 12/13, 22/24, 50/55, 100/110, 200/20, 230/50

"ADCOLA" PVC & POLYTHENE ELECTRICAL CABLE STRIPPERS ALSO AVAILABLE IN ALL VOLT RANGES.

WRITE FOR CATALOGUES

ADCOLA PRODUCTS LTD.

Head Office & Sales: GAUDEN ROAD, CLAPHAM HIGH STREET, LONDON, S.W.4. *MACaulay 4272*

MAINS TRANSFORMERS

FULLY INTERLEAVED SCREENED AND IMPREGNATED. ALL GUARANTEED. ALL PRIMARIES ARE 200/250 v. Half Shrouded.

HSM63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps 16/3
HS63. Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps. 16/6
HS40. Windings as above. 4 v. at 4 amps., 4 v. at 2 amps..... 16/6
Output
HS2. 250-0-250 v. 80 m/a. 19/-
HS3. 350-0-350 v. 80 m/a., 19/-. **HS30.** 300-0-300 v. 80 m/a. 19/-
HS2X. 250-0-250 v. 100 m/a., 21/-. **HS75.** 275-0-275 v. 100 m/a. 21/-
HS30X. 300-0-300 v. 100 m/a., 21/-. **HS3X.** 350-0-350 v. 100 m/a. 21/-

Fully Shrouded

FSM63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps. 5 v. 2 amps. 16/9
Output
FS2. 250-0-250 v. 80 m/a. 21/-
FS30. 300-0-300 v. 80 m/a., 21/-. **FS3.** 350-0-350 v. 80 m/a..... 21/-
FS2X. 250-0-250 v. 100 m/a., 23/-. **FS75.** 275-0-275 v. 100 m/a. 23/-
FS30X. 300-0-300 v. 100 m/a., 23/-. **FS3X.** 350-0-350 v. 100 m/a. 23/-
All the above have 6.3 4-0 v. at 4 amps., 5-4-0 v. at 2 amps.
FS43. Output 425-0-425 v. 200 m/a., 6.3 v. 4 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded 47/6
FS50. Output 450-0-450 v. 250 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded 67/6
FS3X. Output 350-0-350 v. 250 m/a., 6.3 v. 6 amps., 4 v. 8 amps., 4 v. 3 amps., 0-2-6.3 v. 2 amps. Fully shrouded 65/-
FS160X. Output 350-0-350 v. 160 m/a. 6.3 v. 6 amps., 6.3 v. 3 amps., 5 v. 3 amps. Fully shrouded 44/-
FS43X. Output 425-0-425 v. 250 m/a., 6.3 v. 6 amps., 6.3 v. 6 amps., 5 v. 3 amps. Fully shrouded 63/6
HS6. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. For receiver R1355. Half shrouded 26/6
HS150. Output 350-0-350 v. 150 m/a., 6.3 v. 3 amps., C.T. 5 v. 3 amps. Half shrouded 27/9
F36. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. Fully shrouded 29/6
FS120. Output 350-0-350 v. 120 m/a., 6.3 v. 2 amps., C.T. 6.3 v 2 amps. C.T. 5 v. 3 amps. Fully shrouded 29/9
FS256. Output 250-0-250 v. 80 m/a., 6.3 v. at 6 amps., 5 v. at 3 amps. Fully shrouded 28/6
PRI/1. Output 230 v. at 30 m/a., 6.3 v. at 1.5/2 amps..... 21/-
FS150. 350-0-350 v. 150 m/a. 6.3 v. 4 amps., 5 v. 3 amps..... 31/6
FS150X. Output 350-0-350 v. at 150 m/a., 6.3 v. at 2 amps. C.T. 6.3 v. at 2 amps., C.T. 5 v. at 3 amps. Fully shrouded... 31/6
The above have inputs of 200/250 v.

OUTPUT TRANSFORMERS

MIDGET OP. 5,000Ω to 3Ω 3/9
8,000Ω to 3Ω 3/9
MOP1. Ratios, 26, 46, 56, 66, 90, 120-150 m/a. max. current, C.T. for Q.P.P. Class B, etc. Secondary 2/4 ohms. Top panel, and clamped, each 5/6
OP10. 10/15 watts output. 20 ratios on Full and Half Primary 17/9
OP30. 30 watts output. 20 ratios on Full and Half Primary... 25/9
Williamson's O.P. Transformer to Author's specification... £4/4/-
Chokes for Williamson's Amplifier, 30 H. at 20 m/a..... 16/6
10 H. at 150 m/a. 32/-

FILAMENT TRANSFORMERS

All 200/250 v. Input.

F3. 6.3 v. @ 3 amps. 9/6
F4. 4 v. @ 2 amps., 7/6. **F6.** 6.3 v. @ 2 amps. 7/6
F6X. 6.3 v. @ 0.3 amps., 5/6. **F12X.** 12 v. @ 1 amp. 8/-
FU6. 0-2-4-5-6.3 v. @ 2 amps., 10/-. **F12.** 12.6 v. tapped 6.3 v. @ 3 amps. 16/6
F24. 24 v. tapped 12 v. @ 3 amps. 23/6
F29. 0-2-4-5-6.3 v. @ 4 amps., 18/9. **FU12.** 0-4-6.3 v. @ 3 amps. 17/6
FU24. 0-12-24 v. @ 1 amp 17/6
F5. 6.3 v. @ 10 amps. or 5 v. @ 10 amps., or 12.6 v. @ 5 amps., or 10 v. @ 5 amps. 34/-
F6/4. Four windings at 6.3 v. tapped 5 v. @ 5 amps. each, giving by suitable series and parallel connections up to 6.3 v. @ 20 amps. 51/6

Quotations, etc.—stamped addressed envelope, please

C.W.O. (add 1/6 in £ for carriage).

Export enquiries invited.

H. ASHWORTH (Dept. W.W), 676, Gt. Horton Road, Bradford 7, Yorks.

Have your cake-and eat it!

Take your annual holidays —

Reading through this Magazine you will find a variety of equipment that you would like to possess immediately, apart from the items we list in our own advertisements. Our PERSONAL CREDIT PLAN will allow you to do this. We are now introducing a further facility to assist our customers, this being the reduction of the initial deposit to only 20/– with eight further monthly payments. We are extending hire purchase facilities also to 18 months if so desired. A selection of equipments is tabulated below, but space prevents us from listing the vast range we have available. Whatever you want, send us your enquiry (S.A.E.), and if it is available we will supply it. All prices are ex warehouse. Please add to your deposit sufficient to cover carriage and packing.

and buy your Electronic Equipment at the same time for only £1 deposit

SEND ONLY £1 TO SECURE ANY EQUIPMENT

ITEM	CASH PRICE	CREDIT SALE £1 dep. 8 inst.	HIRE PURCHASE Deposit	12 inst. (Instalments are monthly)	18 inst. (Instalments are monthly)
AMPLIFIERS AND TUNERS					
Goodsell	£ s. d.	s. d.	£ s. d.	s. d.	s. d.
GW18 Williamson	£33 5 0	90/-	£11 1 8	42/5	28/6
GW12 Williamson	£27 10 0	74/-	£9 3 4	35/-	24/-
M48	£13 10 0	36/-	£4 10 0	18/4	12/6
F/TC Tone Control	£10 10 0	28/6	£3 10 0	15/-	10/4
F/U/TC Tone Control	£14 14 0	38/6	£4 18 0	20/-	13/6
PFA Tone Control	£18 18 0	50/-	£3 6 0	24/6	16/8
Lowther AM/FM Tuner	£22 0 0	58/6	£7 6 8	28/-	18/11
Leak					
TL10 Amp. & Pre-amp.	£28 7 0	76/-	£9 9 0	36/2	24/6
Tuner Unit	£35 0 0	94/-	£11 13 4	46/6	31/5
Quad MK. II Amplifier	£42 0 0	114/-	£14 0 0	53/4	36/-
Rogers					
Senior Main Amplifier	£28 0 0	75/-	£9 6 8	35/-	23/7
Senior Control Unit	£15 0 0	39/6	£5 0 0	20/-	13/6
Mark II Baby de Luxe Amp.	£14 0 0	37/6	£4 13 4	19/-	12/10
Mark II Junior Pre-Amp.	£9 0 0	25/-	£3 0 0	13/4	9/-
Mark II Minor Amplifier	£12 17 6	34/6	£4 5 10	17/7	12/-
RD Minor Baffle	£5 15 0	24/6	£2 18 4	13/-	8/9
RD Junior Corner Horn	£18 17 6	50/-	£6 6 0	24/6	16/8
Junior Tuner Unit	£25 6 1	66/6	£8 9 0	31/6	21/6
Hargoyne					
RG1 8-valve Superhet	£23 2 0	61/9	£7 14 0	29/-	19/6
RF1 TRF Tuner	£3 12 6	11/3	£1 4 2	6/4	4/6
A8 Amplifier	£3 19 6	12/6	£1 5 5	7/6	5/6
Chapman					
AM/FM Tuner	£15 0 0	39/6	£5 0 0	20/-	13/6
84 Tuner	£10 0 0	42/-	£3 6 8	21/2	14/4
85/85E Tuner	£21 6 8	56/-	£7 2 3	27/-	18/11
EMG Steep Cutting Filter	£4 10 0	12/6	£1 10 0	8/3	6/-
LOUDSPEAKERS					
Goodmans					
Axiom 150	£10 5 6	28/3	£3 8 6	14/9	10/-
Axiom 102	£9 18 2	27/-	£3 6 0	14/4	9/9
Axiom 101	£6 12 1	18/9	£2 4 0	10/7	7/6
Axiom 22	£14 14 0	38/6	£4 18 0	20/-	13/6
Tannoy					
15in. Dual Concentric	£33 10 0	90/-	£11 3 4	42/5	28/6
12in. Dual Concentric	£27 10 0	73/6	£9 3 4	36/-	25/-
Wharfedale					
W12CS	£9 15 0	26/9	£3 5 0	14/2	9/8
W10CSB	£12 6 6	33/6	£4 2 6	16/11	12/-
Super 8 CSAL	£6 13 3	18/9	£2 4 5	10/9	7/9
Golden 10	£7 13 3	21/6	£2 11 1	11/10	8/3
Bronze 10	£4 12 8	14/-	£1 10 11	8/2	5/9
W.B.					
HF 610	£2 10 6	8/6	16 10	6/-	4/2
HF 810	£3 0 6	9/8	£1 0 2	6/6	4/6
HF 912	£3 7 0	10/6	£1 2 4	6/11	4/10
HF 1012	£3 13 6	11/6	£1 4 6	7/3	5/2
Lowther PM2	£35 0 0	94/-	£11 13 4	46/6	31/3
GRAMOPHONE UNITS					
Collaro Transcription	£13 9 6	36/3	£4 10 0	18/-	12/5
Connoisseur 3-speed	£23 8 11	64/-	£7 16 4	30/-	21/-
Collaro AC3/534	£10 6 1	27/6	£3 8 9	14/9	10/3
B.S.R. Monarch, complete	£16 10 0	43/9	£5 10 0	21/8	15/-
B.S.R. Regent, complete	£9 4 11	25/6	£3 1 4	12/3	9/2
B.S.R. GU4, with 2 XMS heads	£12 18 0	34/8	£4 6 0	17/8	12/4
Garrard T, less head	£7 11 1	21/-	£2 10 4	11/6	8/1
Plessey Auto Changer, complete	£9 9 6	26/2	£3 3 2	14/-	9/6
Thorens Variable Speed Motor	£32 0 0	85/6	£10 13 4	42/-	29/-

ITEM	CASH PRICE	CREDIT SALE £1 dep. 8 inst.	HIRE PURCHASE Deposit	12 inst. (Instalments are monthly)	18 inst. (Instalments are monthly)
PICK-UPS	£ s. d.	s. d.	£ s. d.	s. d.	s. d.
Connoisseur, with 2 Heads	£9 5 6	25/6	£3 1 10	13/4	9/3
Decca XMS, with 2 Heads	£6 9 3	18/-	£2 3 1	10/-	7/-
Cosmocord HGP39/GP20 Arm	£3 8 4	—	£1 2 9	7/-	4/11
Leak Ruby 78 r.p.m. or LP	£11 11 0	31/-	£3 17 0	15/10	11/-
Ronette Miniweight, with 2 Heads	£3 9 6	—	£1 3 2	7/-	4/11
Ronette Superweight, with 2 Heads	£5 16 3	—	£1 5 5	7/4	5/3
PLAYERS					
Regentone RP2 3-speed	£9 19 6	27/-	£3 6 6	14/6	10/-
Regentone HG2 3-speed Amplifier	£15 15 0	41/6	£5 5 0	20/10	14/3
Regentone AHG2 3-speed Auto Amp.	£11 0 0	55/-	£7 0 0	26/8	18/2
Plus-A-Gram Junior	£9 9 0	26/-	£3 3 0	14/-	9/6
Trixette A.375 3-speed Auto Amp.	£17 16 0	101/-	£12 12 0	48/4	32/8
E.A.R. Auto 3-speed Amplifier	£24 17 6	66/-	£8 5 10	31/6	21/6
E.A.R. Non-Auto 3-speed Amp.	£19 15 0	52/-	£6 11 8	25/4	17/4
Volmar L425 3-speed Auto Amp.	£24 15 6	65/6	£8 4 6	31/6	21/5
TEST EQUIPMENT					
Advance					
P1 Generator	£19 19 0	52/6	£6 13 0	25/6	17/9
J1 Generator	£35 12 0	95/-	£11 17 4	45/6	31/6
E2 Generator	£28 0 0	75/3	£9 6 8	36/6	24/3
H1 Generator	£25 0 0	66/3	£8 6 8	32/-	23/-
Avo					
Model 8 Meter	£23 10 0	64/9	£7 16 8	30/4	21/1
Model 7 Meter	£19 10 0	51/6	£6 10 0	26/-	18/4
Universal Avominor	£10 16 0	29/-	£3 10 0	14/6	10/6
Electronic Test Meter	£40 0 0	107/6	£13 6 8	51/-	35/-
Signal Generator	£30 0 0	80/6	£10 0 0	39/-	27/-
D.C. Avominor	£5 5 0	15/-	£1 15 0	9/2	6/6
Universal Bridge	£34 0 0	91/-	£11 6 8	43/-	29/6
Amplion Test Meter	£5 19 6	17/-	£2 0 0	9/3	6/8
Cossor					
Oscilloscope 1039	£29 10 0	79/6	£9 16 8	37/3	25/9
Oscilloscope 1052	£104 0 0	283/-	£34 13 4	132/10	90/-
Voltage Calibrator 1433	£18 5 0	49/-	£6 1 8	24/-	16/4
Dawe Modulated Test Oscillator	£3 15 0	—	£1 5 0	7/6	5/3
Pullin Series 100 Test Meter	£11 11 0	31/-	£3 0 0	19/6	13/6
Taylor					
44A Meter	£2 10 0	—	16 8	5/-	3/9
77A Universal Meter	£15 0 0	39/6	£5 0 0	20/-	13/9
88A Universal Meter	£22 0 0	57/6	£7 6 8	28/-	19/3
110C Bridge	£14 10 0	38/-	£4 16 8	19/5	13/4
150A Output Meter	£33 10 0	90/-	£11 3 4	42/4	29/-
TAPE RECORDERS, DECKS AND ACCESSORIES					
"EDITOR" Recorder	£47 5 0	132/6	£15 15 0	60/-	42/-
GRUNDIG TK9 Recorder	£68 5 0	189/-	£22 15 0	84/6	59/-
709L Recorder	£84 0 0	230/-	£28 0 0	106/9	73/6
BAIRD Soundmaster Recorder	£68 5 0	189/-	£22 15 0	86/6	59/-
MS8 Recorder	£99 15 0	273/-	£33 5 0	126/3	86/-
VORTEXION 2A Recorder	£84 0 0	230/-	£28 0 0	106/9	73/6
FERROGRAPH 2A Recorder	£79 16 0	220/-	£26 8 8	101/7	69/3
TRUVOX Tape Deck	£23 2 0	63/6	£7 14 0	29/-	19/6
WEARITE 2A Tape Deck	£35 0 0	94/-	£11 13 4	46/6	31/6
2B Tape Deck	£40 0 0	107/6	£13 6 8	51/-	35/-
LANE Tape Deck	£17 10 0	46/-	£5 16 8	22/-	15/3
BURGOYNE Oscillator Unit	£2 2 0	—	14 0	4/-	3/-
GRUNDIG Moving Coil Microphone for TK9	£6 6 0	18/-	£2 2 0	10/-	7/-
TRUVOX Radio Jack	£3 19 11	—	£1 6 8	7/-	4/11
VORTEXION 4-channel Electronic Mixer	£36 15 0	98/-	£12 5 0	46/9	33/-

SEE THEM AT THE RADIO CENTRE

M·O·S

E. & G. MAIL ORDER SUPPLY CO.

33 Tottenham Court Road, London, W.1. Telephone MUSeum 6667

MUREX information booklets on ZIRCONIUM & TANTALUM

P.51—Tantalum & Zirconium. Properties and corrosion resistance data, together with tables giving dimensions of rod, wire, sheet and tube.

P.20—Machining of the Rarer Metals. Recommendations for machining tungsten, molybdenum, tantalum, zirconium and titanium.

Reprint Murex Review Vol. I No. II — Welding Zirconium. Methods for the production of ductile welds in Zirconium.

Reprint Murex Review Vol. I No. 8 — Zirconium. Production properties and applications.

Reprint Murex Review Vol. I No. 5 — Tantalum. Production properties and applications.

MUREX LTD *(Powder Metallurgy Division),*
RAINHAM, ESSEX. *Rainham, Essex 3322*
London Sales Office: Central House, Upper Woburn Place, W.C.1. EUSton 8265

25 years' progress in Plastics and what it means to you

Do you know the extent to which plastics are now used in radio, T.V. and electronics? In July, BRITISH PLASTICS will tell the story of plastics over 25 years, showing how its materials and processes have developed, and how its products have improved and in many cases extended the usefulness of those in other industries—*including your own.* A survey of exceptional value to every industrialist. Plan for the future with the July BRITISH PLASTICS.

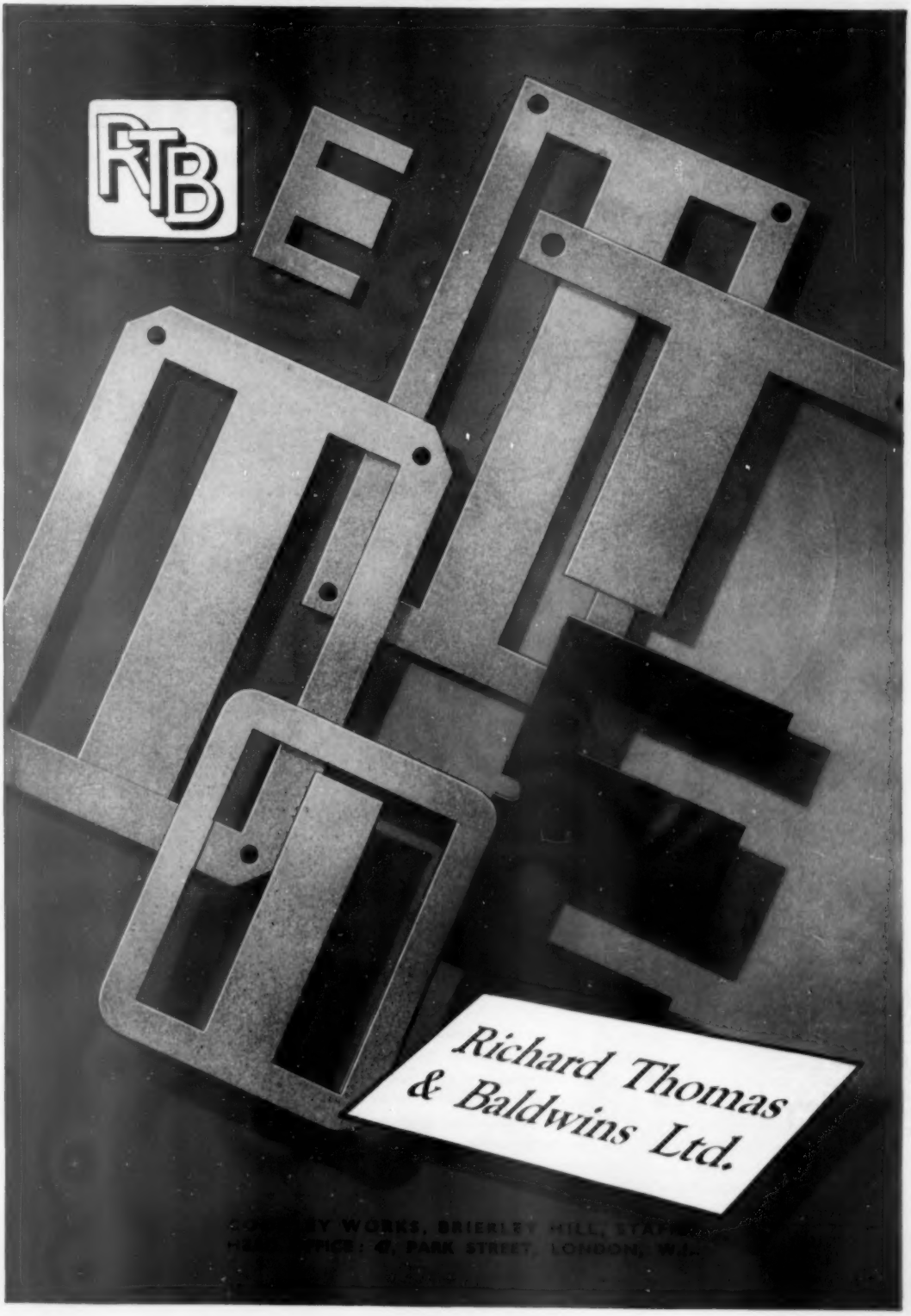
Order your copy now—2/6d. (by post 3/-).

25th ANNIVERSARY ISSUE

BRITISH PLASTICS

July 1954

FROM YOUR NEWSAGENT OR DIRECT FROM DORSET HOUSE, STAMFORD ST. LONDON S.E.1

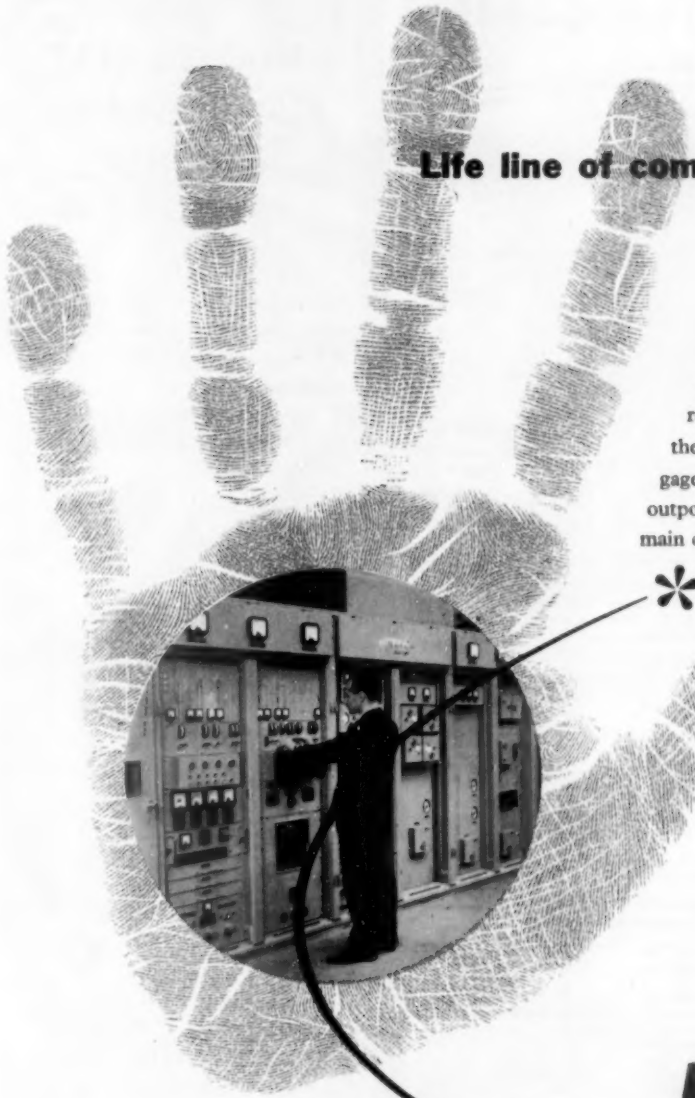

RTB
Richard Thomas
& Baldwins Ltd.

THE MOST MODERN ENGINEERING ACHIEVEMENT IN RESISTORS

THE exceptional characteristics of this range of resistors are such that they are eminently suitable for use in the most stringent conditions of service. The B.T.S. $\frac{3}{8}$" x $\frac{1}{8}$" light weight unit of $\frac{1}{2}$ watt rating at 70°C has a technical perfection, tested over long periods, to suit the complex and exacting circuitry of modern radio and television. This resistor gives outstanding performance under severe tropical conditions and has generous overload properties thus setting a high standard for all fixed resistors. *Catalogue R*11 *available upon request.*

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON, W.3
'Phone: Acorn 2241 (5 lines) 'Grams: Hivoltcon, Wesphone, London
Cables: Hivoltcon, London. Marconi International Code

D36D (Rev.)



Life line of communication...

Wherever desert, swamp, mountain, jungle or snowfields render the erection and maintenance of line or cable routes difficult and costly, V.H.F. multi-channel radio telegraph and radio telephone systems can provide the link. Marconi's are actively engaged the world over in bringing outposts into continual touch with the main communities.

COMPLETE RADIO/TELEPHONE AND RADIO/TELEGRAPH SYSTEMS AND EQUIPMENT

MARCONI

COMPLETE COMMUNICATION SYSTEMS

Surveyed, Planned, Installed, Maintained

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED · CHELMSFORD · ESSEX

LG1

For literature and full information apply to:

Argentine.
Industrias Electricas y Musicales Odeon S.R.L.,
Av. Corrientes 485,
Buenos Aires.

Australia.
E.M.I. (Australia) Pty. Ltd.,
301 Castlereagh Street,
Sydney, N.S.W.

Austria.
Oesterreichische Columbia Graphophon Gesellschaft m.b.H.,
1/1 Fuehrichgasse 2,
Vienna 1.

Belgium.
S.A. Gramaphon N.V.,
Boulevard Maurice Lemonnier 171,
Brussels.

Brazil.
Industrias Eletricas e Musicais Fabrica Odeon S.A.,
Av. Rio Branco 99 - 14:, 15: Andar,
Rio de Janeiro.

Chile.
Industrias Electricas y Musicales Odeon S.A.,
Casilla 186-D,
Santiago.

Denmark.
Skandinavisk Grammophon A/S,
Hoffdingsvej 18,
Copenhagen - Valby.

Kenya & Uganda.
East Africa Music Stores Ltd.,
P.O. Box 578, Nairobi.

Egypt.
Green's Commercial Agencies,
147, Mohamed Bey Farid, Cairo.

Eire.
The Gramophone Co. Ltd.,
35 Parliament Street,
Dublin.

Finland.
Pohjoismainen Sahko-Osakeyhtio,
Vuorikatu 14,
Helsinki.

France.
Les Industries Musicales et Electriques Pathé Marconi, S.a.v.i.,
251 et 253 Rue du Faubourg Saint-Martin,
Paris Xe.

Germany.
Electrola Gesellschaft m.b.H.,
Cologne-Braunsfeld, Maarweg 149.

Greece.
Columbia Graphophone Co. of Greece Ltd.,
P.O. Box 287, Athens.

Holland.
N.V. Verkoop-Maatschappij "Bovema"
Gramophone House, Bronsteeweg 49,
Heemstede.

Hong Kong.
Columbia Graphophone Co. Ltd.,
P.O. Box 2290.

Iceland.
Falkinn Ltd.,
Laugaveg 24, Reykjavik.

India.
The Gramophone Co. Ltd.,
P.O. Box 48, Calcutta.

Italy.
La Voce del Padrone, Columbia, Marconiphone, S.A.
Via Domenichino 14,
Milan.

Malaya.
The Gramophone Co. Ltd.,
Macdonald House, Orchard Road,
P.O. Box 182, Singapore 9.

New Zealand.
His Master's Voice (N.Z.), Ltd.,
162-172 Wakefield Street,
Wellington, C.1.

Norway.
Electric and Musical Industries Ltd.,
Norsk Avdeling, Klingenberggt 4,
Oslo.

Portugal.
Est., Valentin de Carvalho, Lda.,
R. Nova Do Almada,
95-97, Lisbon.

S. Africa.
Telecommunications & Electronics Africa Ltd.
P.O. Box 10523,
Johannesburg.

Spain.
Compañia del Graméfono-Odeon, S.A.E.,
Urgel 234,
Barcelona.

Sweden.
Skandinaviska Grammophon A/B,
Sandhamnsgatan 39,
Stockholm, O.

Turkey.
Vahram Gesar & Cie.,
Istiklâl Caddesi 302,
Beyoğlu—Istanbul.

West Pakistan.
The Gramophone Co. Ltd.,
7 Spencer's Building, McLeod Road,
Karachi.

Enquiries from territories not listed above should be directed to:

ELECTRIC AND MUSICAL INDUSTRIES LTD.
INTERNATIONAL DEPARTMENT,
Hayes, Middlesex, England.
Cables: Emiglobe, London.
Inland Telegrams: Emitron, Telex, London.
Telephone: Southall 2468.

E.M.I.

MAGNETIC TAPE SOUND RECORDING EQUIPMENT AND EMITAPE

✻

HIGH FIDELITY RECORDING EQUIPMENT INTERNATIONALLY USED BY ALL LEADING RECORDING AND BROADCASTING ORGANISATIONS.

MODEL BTR/2

The Studio Tape Recorder with the background of fifty years of research and experience in the science of sound recording and reproduction. Developed by E.M.I. (The Gramophone Co. Ltd., Columbia Graphophone Co. Ltd., The Parlophone Co. Ltd.), the BTR/2 meets the exacting needs of professions which demand supreme accuracy in sound recording and reproduction.

Modesty forbids...

...that we reproduce all the letters of appreciation we receive. But when one like this turns up what can we do?

261 Heather Road,
Small Heath,
Birmingham.

Dear Sir,

I do a great deal of record reproducing as a pastime I have already made a corner cabinet for the Audiom 60 and the sound production is simply marvellous, and in my honest opinion I think it is superb.

I have had all different types but never have I found anything to equal the Audiom type of reproducer.

What other loudspeaker could bring forth greater genuine praise?—except, perhaps, another Goodmans' High Quality reproducer. What immense versatility this high-powered, single cone AUDIOM 60 has! The secret?—fine sensitivity plus robust construction. The AUDIOM 60 will work as well from a domestic radio receiver as it does in an Electronic organ. For radio and record reproduction of varied input, it will reduce background noise encountered in the playing of vintage recordings—and more—because of its low harmonic and intermodulation distortion the AUDIOM 60 is extensively used as a bass unit in cross over networks, whilst its success as a P.A. unit is widely acclaimed.

AUDIOM 60

BRIEF SPECIFICATION

*Fundamental Resonance	75 c/s
Voice Coil Impedance	15 ohms
Power handling capacity	15 watts peak A.C.
Flux density	14,000 gauss
Net weight	12 lb 3 oz.
Price	**£8 12 6**

(Free of Purchase Tax)

**The AUDIOM 60 is available with 35 and 55 c.p.s. Bass Resonances. These two units are particularly suited for High Fidelity cross over systems. A suitable treble unit for the AUDIOM 60 is the AXIOM 101.*

Drawings of Bass Reflex Chambers are available on demand for all units.

GOODMANS

GOODMANS INDUSTRIES LIMITED, AXIOM WORKS, WEMBLEY, MIDDLESEX, ENGLAND.

Telephone: WEMbley 1200. Cables: Goodaxiom, Wembley, England.

C

Hi Fi HIGH FIDELITY

AMPLIFIER

THE PF91 amplifier, with its PF91A remote control unit, is the culmination of many years of research into the problem of Hi Fi reproduction. Its performance will astound the ordinary listener and critical engineer alike. Record players, tape recorders, microphones or radio tuners can be used with the PF91—a versatile and practical unit for those who demand perfect sound reproduction in the home, the school, the broadcasting studio or the social club.

MODEL PF 91 28 GNS.
MODEL PF 91A 12 GNS.

POST COUPON FOR FURTHER DETAILS

PYE LIMITED
BOX 49 · CAMBRIDGE

Please send me the fully comprehensive 24-page booklet on the PF91/91A Hi Fi Amplifier.

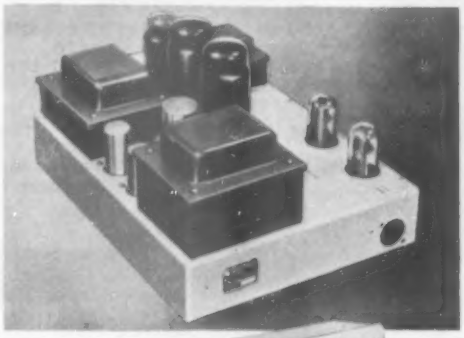
If you would like a demonstration at a Pye Dealer's in your area, please place a tick in this box ☐

NAME.....

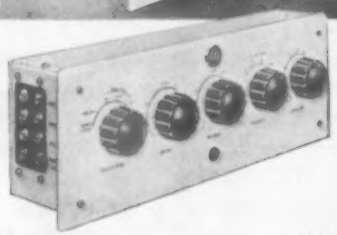
ADDRESS.....

.....

W.W.1



PF91



PF91A

POWER AMPLIFIER PF91.

26 db negative feedback and an ouput from 2 c.p.s. to 160,000 c.p.s. (over 16 octaves).

A combination of negative and positive feedback raises the damping factor of the amplifier to infinity thereby ensuring full control of loudspeaker speech coil movement.

The accurate reproduction of sounds rich in harmonics sets a new standard in the enjoyment of modern recordings.

The output transformer is a specially designed component to meet the exacting specification of the amplifier.

The Power Amplifier is capable of handling peak power pulses in excess of the maximum rating without noticeable distortion.

REMOTE CONTROL UNIT PF91A.

This unit allows remote control of the amplifier up to a distance of 20 ft. (6m).

Cathode follower output from the Remote Control unit reduces cable losses when the Power Amplifier is remotely controlled.

Four switched inputs and the choice of three equalisation networks for L.P., N.A.B. and 78 recording characteristics.

Continuously variable lift and cut controls for bass and treble with clearly marked level positions.

Incorporates a treble filter control, giving three sharp cut-off frequencies and an unrestricted response position.

The Pre-Amplifier incorporated ensures sufficient gain on all inputs for the full loading of the Power Amplifier.

PYE LIMITED OF CAMBRIDGE

incorporating the outstanding PYE PF91 amplifier

the Layton Trolleygram

registered trade mark

We have been so impressed with the Pye PF91 Amplifier that we have decided to make it the nucleus of a new high fidelity service. The first in this range is the Layton Trolleygram designed specially to house this remarkable Amplifier together with its associated equipment. Ask us to send you details if you are at all interested or, better by far, visit us and see and hear it in our showrooms.

IMHOFS

new gliding caster system

floating motor-board

wide choice of radio and

player units

separate or incorporated speaker

compact contemporary design

other models available

Alfred Imhof Ltd. 112-116 New Oxford St., London WC1. Tel: MUSeum 7878

Treasure your Valves !

Valves are a sensitive lot. Their delicate constitutions are easily shocked by unsympathetic vibrations transmitted through the chassis. That's why they need to be protected by *McMurdo Antimicrophonic Valveholders.*

These holders have special resilient mountings which absorb unpleasant shocks and knocks. The B9A and B7G holders are both screened and unscreened while B8A is unscreened. All are available in P.V.C. or Silicone rubber mountings. Use P.V.C. when operation temperature does not exceed 50° C and Silicone rubber up to 120° C. For full details write for information to-day.

THE · McMURDO · INSTRUMENT · CO · LTD Victoria Works, Ashtead, Surrey
Telephone: ASHSTEAD 3401

It's a DELIBERATE MISTAKE if you don't make sure of NATURAL REPRODUCTION

With a **BAKERS** *Permanent Magnet* **LOUD SPEAKER**

12in. 15 WATT 'DE LUXE' Frequency Range 18 to 17,000 c.p.s. Fundamental Resonance (approx.) 35 c.p.s. Peak A.C. Input (open baffle) 15 watts.

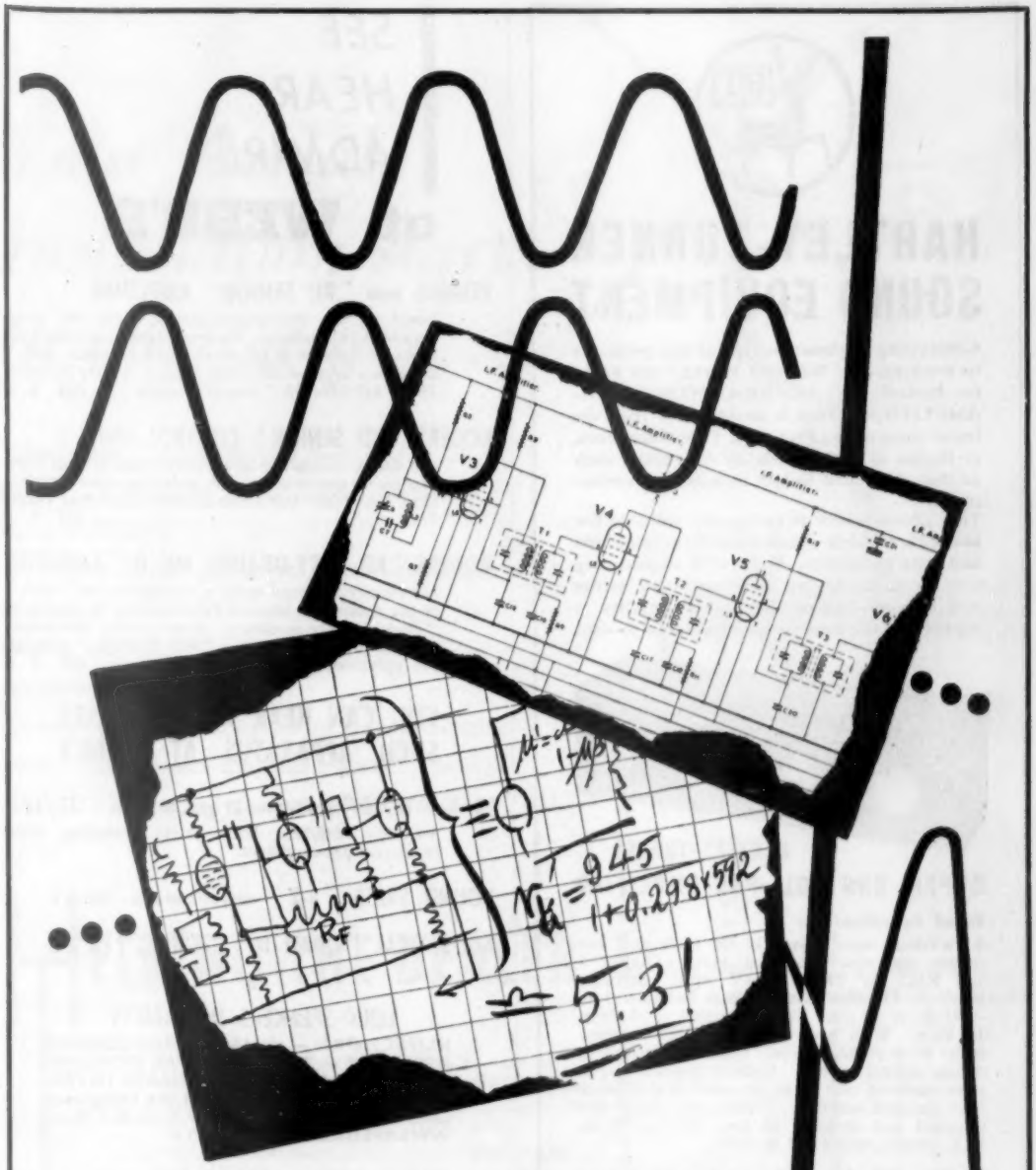
12in. 20 WATT SINGLE CONE Frequency Range 25 to 16,000 c.p.s. Fundamental Resonance (approx.) 45 c.p.s. Peak A.C. Input (open baffle) 20 watts.

15in. 30 WATT 'AUDITORIUM' Frequency Range 20 to 14,000 c.p.s. Fundamental Resonance (approx.) 40 c.p.s. Peak A.C. Input (open baffle) 30 watts.

The "Selhurst" corner cabinet finished in walnut, oak or mahogany provides the perfect housing for all BAKER Speakers. 5 cubic ft. and 8 cubic ft. Models Available.

BAKERS 'Selhurst' RADIO

Please write for full details to :
24 DINGWALL ROAD, CROYDON, SURREY. Croydon 2271/2
Sole Distributors for Eire : BRIAN CURRAN, 283 Harold Cross Road, TERENURE, DUBLIN



Advanced and extensive research and development combined with unequalled field experience places B.C.C. equipment in a class by itself.

B.C.C. Sets the Standard.

BCC **BRITISH COMMUNICATIONS CORPORATION LIMITED**

Second Way, Exhibition Grounds, Wembley, Middlesex. *Telephone : Wembley 1212*

HARTLEY-TURNER SOUND EQUIPMENT

Continuing the introduction of our products to readers of "Wireless World," we bring to notice our SUPER-CONTROL-PRE-AMPLIFIER. This is designed to feed the input source, i.e., Pick-ups, Tape Recorders, or Radio, to a High Fidelity Amplifier, such as that described in last month's advertisement.

This preamplifier is eminently suitable for use with all high-grade amplifiers, pick-ups and tape recorders. Built with engineering precision, employing sub-miniature valves and components of the highest quality it represents the best value obtainable to-day.

HARTLEY-TURNER

SUPER CONTROL PRE-AMPLIFIER

Brief Specification:

4 switched input channels for high and low output pick-ups, tape and radio. Output 1 volt RMS for 25mV or 1V input. Separate Bass and Treble controls; Bass variable 0 to +30 db at 20 c/s. Treble variable ±10 db at 10 Kc/s. With both controls at zero response is flat from 20-50,000 c/s. Volume independent of tone control settings. Cathode follower output stage enabling unit to be operated at a distance from the main amplifier. Whole unit completely screened and enclosed in case 10½ × 3½ × 3½ in. H.T. supply only 3 mA at 250V.

PRICE: £8 18 6 Complete with Valves

Illustrated descriptive literature on all our products sent free and post free, including details of our Long Playing Record Supply Service.

H. A. HARTLEY Co. Ltd.,

152, HAMMERSMITH ROAD, HAMMERSMITH LONDON, W.6.

Telephone : RIVerside 7387

SEE HEAR ADMIRE at WEBB'S

ROGERS new "RD SENIOR" AMPLIFIER

based on the Williamson circuit, with the latest Partridge ultra-linear C-core output transformer. Power output of 15/20 watts, peak 25 watts, with a distortion factor of .08% for 15 watts, .3% for 20 watts. The "RD SENIOR" amplifier costs **£28 0 0**

ROGERS "RD SENIOR" CONTROL UNIT

is a fitting companion and incorporates a most comprehensive degree of control, including a two-position, High Pass Filter and three-position, Low Pass Filter. Price **£15 0 0**

ROGERS "RD BABY-DE-LUXE MK II" AMPLIFIER

has already achieved quite a reputation for "hi-fi" at the reasonable price of £23 including its attendant "Mark II" pre-amplifier. Alternatively, the amplifier can be used with the "RD SENIOR" control, the combined price being..... **£29 0 0**

YOU CAN HEAR AND COMPARE SUCH APPARATUS AT WEBB'S

LEAK "TL/10" Amplifier 27 gns. & LEAK "TL/12" Amplifier, £40/19/-, both prices including their respective pre-amplifiers.

SOUND SALES "A-Z" with control unit £32. 0. 0.

ACOUSTICAL "QUAD II" Amplifier with "QC. II" control unit - £42. 0. 0.

★

LOUD-SPEAKERS IN VARIETY

KLIPSCHORN — WHARFEDALE CORNER ASSEMBLY — TANNOY DUAL CONCENTRIC — SOUND SALES "PHASE INVERTER" — VOIGHT — and all the recognised units by GOODMANS — W.B. — B.T.H. — WHARFEDALE — VITAVOX.

WE ARE THE MAIN LONDON DISTRIBUTORS FOR ALL

EDDYSTONE PRODUCTS

COMMUNICATIONS RECEIVERS

Types "680X" — "770R" — "840" — "740" from stock. Also, full range of EDDYSTONE components always available.

WEBB'S Radio

14 SOHO STREET, OXFORD STREET, LONDON, W.1

Tel.: GERrard 2089. Shop Hours: 9 a.m.—5.30 p.m. Sats. 9 a.m.—1 p.m.

Your Aerial Installation starts in our factory...

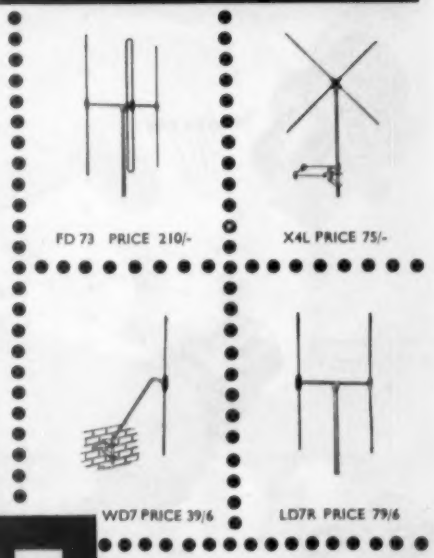
" Antiference " stands for more than just fine TV aerials . . . it stands for full and careful attention to the dealer's needs.

Antiference Aerials come to you pre-assembled and aligned. This factory assembly not only saves you erection and installation time; it guarantees top performance as well.

Remember too that Antiference Aerials are corrosion-proof. The capacitor couplings guarantee life-long electrical efficiency and eliminate servicing worries.

HELPING THE DEALER

Antiference policy is two-fold. First, by constant research and high engineering skill, to produce the finest possible aerials. (Remember how Antiference pioneered the Antex Aerial.)
Secondly, by careful design, to save the dealer all possible time on his erection service. We're pledged to help the dealer to the full.



ANTIFERENCE
LIMITED

BICESTER ROAD, AYLESBURY, BUCKS. *Telephone : Aylesbury* 1467/8

DIB/A/1

-towards perfection-

Walnut finish £96
(as illustrated Ex-works)

1. THE LOWTHER CORNER REPRODUCER

The Finest Reproducer yet designed, covering the audio range, giving high definition, bass and treble transient, with a single driver unit.

New leaflet now available

2. LOWTHER F. M. TUNER

Tunable 85-100 m.c.s. for F.M. experimental transmissions from Wrotham and other sites as erected.

Quality reception guarantee on live broadcasts. Free from whistles and general background noises.

£22 complete

3. LOWTHER MASTER CONTROL UNIT

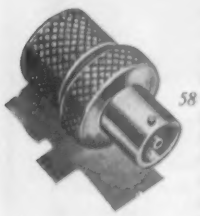
is completely indispensable to arrive at a satisfying characteristic for reproduction. **£20 complete**

4. THORENS GEAR DRIVE VARIABLE SPEED GRAMOPHONE MOTOR UNIT E53PA

—the last word in precision. **£32 complete**

THE LOWTHER MANUFACTURING COMPANY, ST. MARKS ROAD, BROMLEY, KENT
Telephone : RAVensbourne 5225

TELCONNECTORS

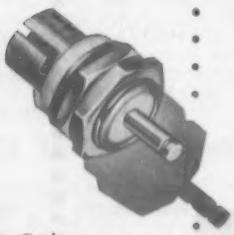


58 series plug

co-axial plugs and sockets

The connectors illustrated are designed for use with the smaller diameter R.F. cables, such as Telcon PT.1.M, PT.11.M, AS.60.M, etc. Produced for instrument designers and general application, the 58 Series Plug and Socket has a capacitance of less than 7 μμF. The 58C panel mounting socket shown will accept any plug in the 58P Series.

Panel Mounting Socket, type 58C



Socket, type 58 S/V

All types are readily available in various sizes and combinations. Write for publication T/1.

TELCON RF cables

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD

Head Office: 22 Old Broad Street, London, E.C.2. *Tel.:* LONdon Wall 7104
Enquiries to: Telcon Works, Greenwich, London, S.E.10. *Tel.:* GREenwich 3291

ADVANCE COMPONENTS LTD., MARLOWE ROAD, WALTHAMSTOW, LONDON, E.17. Telephone : LARkswood 4366/7/8

7·5 to 250 Mc/s
ON FUNDAMENTALS
IN FIVE RANG
SINE A
SQUARE
MODULA
R.F. OUTPUT
1 μV to 100 m

a New SIGNAL GENERATOR for BAND 3 SERVICING

Advance

Again Advance lead the way—this time with a V.H.F. Signal Generator covering 7·5 to 250 Mc/s, a range that embraces Bands 1 and 2 *and also the impending Very High Frequency Television Transmissions on Band* 3. Moreover, this instrument is available at a price well within the reach of every service man. In the traditional Advance manner, this instrument is designed for simple operation and with a versatility that not only fulfils present needs, but anticipates the even more exacting requirements to deal with the television test problems of tomorrow.

Below are some outstanding features:-

- WIDE RANGE—7·5 to 250 Mc/s
- SINE AND SQUARE WAVE MODULATION (*internal and external*)
- RELIABLE ATTENUATION
- LOW LEAKAGE—*less than 3 microvolts*
- TRULY PORTABLE—*weighs only 17lbs.*
- COMPETITIVE PRICE

Full technical details available in Folder W23 on request.

£45
(List price in U.K.)

MODEL Q1

The Q1 provides the ideal complement to the Model E2. These together give complete coverage from 100 kc/s to 250 Mc/s.

ADVANCE COMPONENTS LTD., MARLOWE ROAD, WALTHAMSTOW, LONDON, E.17. Telephone : LARkswood 4366/7/8

GD D

Connoisseur *with DIAMOND STYLUS!*

Facsimile in Sound

The SUPER LIGHTWEIGHT PICK-UP

can now be supplied to order—

with an armature system fitted with diamond stylus. Price complete with one head (either Standard 78 r.p.m., or Microgrove, 33⅓ and 45 r.p.m.) fitted with diamond stylus £7.12.9d. plus Purchase Tax £2.9.0d. Each additional head £5.12.9d. plus Purchase Tax £1.16.2d. Replacement armature system fitted with diamond stylus £3.13.0d. plus Purchase Tax £1.3.5d.

3 HEAD PICK-UP

Existing model with sapphire system still available.

3 SPEED MOTOR

New Price:

Retail Price ..	£17	15	0
Purchase tax ..	5	13	11
Total Price ..	£23	8	11

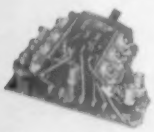
3 SPEED MOTOR

A. R. SUGDEN & CO. (ENGINEERS) LTD.

WELL GREEN LANE, BRIGHOUSE, YORKSHIRE. Tel: HALIFAX 69169

Telegrams: "Connoisseur, Brighouse"

OVERSEAS AGENTS: **S. Africa**: W. L. Procter (Pty.) Ltd. 63 Strand Street, Cape Town. **Australia**: J. H. Magrath & Co. Pty. Ltd. 208 Little Lonsdale Street, Melbourne. **Canada**: The Astral Electric Co. Ltd., 44 Danforth Road, Toronto 13, Ontario. **New Zealand**: Turnbull & Jones Ltd., Head Office, 12/14 Courtenay Place, Wellington. **Hong Kong**: The Radio People Ltd., 31, Nathar Road, Hong Kong. **Malaya**: (Main Distributors) Eastland Trading Co., 1 Prince Street, Singapore.



OSMOR

radio products ltd.

(Dept. W.55) 418, BRIGHTON ROAD, SOUTH CROYDON, SURREY. *Telephone*: **Croydon 5148/9**

These really powerful units in compact form give quality and performance right out of proportion to their midget size and modest cost. Osmor "Q" Coilpacks have everything that only the highest degree of technical skill can ensure—**extra selectivity, super sensitivity, adaptability.** Size only 1⅞ x 3½ x 2½, with variable iron-dust cores and Polystyrene formers. Built-in trimmers. **Tropicalised. Prealigned,** receiver tested and guaranteed. Only 5 connections to make. All types for Mains and Battery superhets, and T.R.F. receivers. Ideal for the reliable construction of new sets, also for conversion of the 21 Receiver, TR.1196, Type 18, Wartime Utility and others. Send today for particulars!

CHASSIS CUTTER

Type	Hole Sizes
1	⅛in. x 1¼in.
2	⅛in. x 1⅝in.
3	⅛in. x 1¾in.
4	1⅛in. x 2in.

Illust. price list on request.

I.F.s. 465 k/c. Permeability-tuned with flying leads. Standard size 1⅞in. x 1⅝in. x 3¼in. For use with OSMOR coilpacks and others, **14/6** pair. **MIDGET I.F.s.** 465 K/c. ⅝in. x ⅝in. x 2½in. 21/- pair. **PRE-ALIGNED 1/6 extra.** Both types.

FREE! Send 5d. (stamps) for literature including The really efficient 5 valve Superhet Circuit and practical Drawings, 6-valve ditto, 3-valve (plus rectifier) T.R.F. circuit, Battery portable superhet circuit, Coil and Coilpack leaflets, Chassis Cutter leaflet, radio and component lists, and interesting miniature circuits, etc.

TYPE	METRES
1 —	141-250
2 —	218-283
3 —	267-341
4 —	319-405
5 —	395-492
6 —	455-567
7 —	1450-1550
8 —	410-550 k/c

OSMOR STATION SEPARATOR 7/6 POST FREE

The Separator may easily be tuned to eliminate any one station within the ranges stated and fittings takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.
Complete with plug, socket and full instructions —nothing to add.

SEPARATE COILS 4/-

A full range is available for all popular wavebands and purposes. Fully descriptive leaflets and connection data available. Just note these "5 Star" Features.

★ **Only 1in. high.** ★ **Packed in dampproof containers.** ★ **Variable iron-dust cores.** ★ **Fitted tags for easy connection.** ★ **Low loss Polystyrene formers.**

We keep stocks of many radio components for use in published circuits, including:—

"WIRELESS WORLD"

"No Compromise" TRF Tuner. "Midget Mains Receiver." Sensitive 2-valve Receiver. Television Converter (special coils in cans available), Midget Sensitive TRF.

"PRACTICAL WIRELESS"

Coronet Four; Beginners' Superhet; Modern High Power Amplifier 2; Attache Case Portable; R1155 Converter; A.C. Band-Pass 3; Modern 1-valver; 3-speed Autogram and many others.

MW TRF REACTION COIL TYPE QR11 4/9 EACH

A 3-winding coil for use in an aerial or HF stage with variable core. (Matches with coils QA11 and QHF11 at 4/- each.)

For L.W. similar coils QR12 (4/9), QA12 and QHF12 (4/- each) are available.

Various attractive dials to suit coilpacks available.

OUR TECHNICAL DEPT. WILL BE PLEASED TO ANSWER (BY LETTER ONLY) ANY ENQUIRY RELATING TO CIRCUITS IN WHICH OSMOR COILS OR COILPACKS ARE USED OR ARE INTENDED TO BE USED.

They say
we make a perfect
pair...

..with
excellent
connections

To be exact, this is the 12 pin version of the Multi-Way Plug and Socket range, which covers 4, 8, 12, 20 and 28 ways. The range features unusually low insertion pressures, and embodies considerable experience in meeting humid conditions. Designed to overcome as far as possible the difficulties encountered when using this type of connector in rack mounting applications, they have greater latitude in matching up than any comparable product, and are in use throughout the world in Radio, Television and Telecommunications equipment by such renowned firms as:—Messrs. Marconi's Wireless Telegraph Co. Ltd., The English Electric Co. Ltd. and Messrs. Standard Telephones & Cables Ltd.

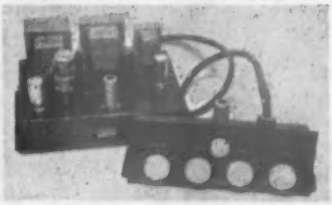
A.I.D & A.R.B – APPROVED

POWER CONTROLS
LIMITED

EXNING RD., NEWMARKET PHONE: NEW 3181/2/3

"Each . . . the best in its class at moderate cost"

Three combinations of amplifier and control unit, forming the ideal basis on which to develop home high fidelity systems, ranging from the best at moderate cost, to the best regardless of cost . . .



RD BABY de-luxe Mk.II amplifier, with RD JUNIOR Mk.II pre-amplifier.

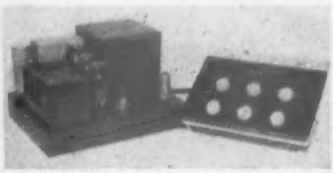
Providing the best performance possible at moderate cost. Adequate output for normal domestic use, operation from the majority of modern lightweight pick-ups, two radio inputs. Wide range bass and treble controls; variable low pass filter.

£23

£29

RD BABY de-luxe Mk.II amplifier, with RD SENIOR Control Unit.

Increased sensitivity and greater flexibility of control. Both high and low pass switched filters and provision for use with tape recorders. Illuminated translucent panel.



RD SENIOR Amplifier and Control Unit.

The ultimate in present day amplifier performance. Increased power output, C-core output transformer, and ultra linear output stage with all its attendant advantages.

£43

Illustrated leaflets post free on request. *Trade and Export enquiries invited.*

ROGERS DEVELOPMENTS CO.

Manufacturers of precision built sound equipment.

"RODEVCO HOUSE," 116, BLACKHEATH ROAD, GREENWICH, LONDON, S.E.10

Telephone: TIDeway 1723. Telegrams: RODEVCO, GREEN, LONDON.

High grade Laboratory Equipment

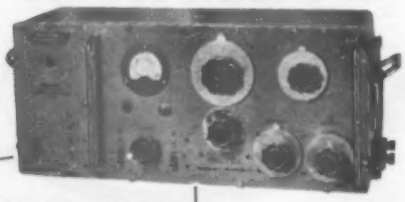
REBUILT & GUARANTEED AS NEW!

We have a comprehensive range of electronic equipment by well known makers, including *Microwave Receivers, Signal Generators* and *Cavity Wavemeters.*

A small selection of other equipment is shown below.

Universal Bridge type TF.373D., Frequency Meters type BC.221, TE.149 and TS.69/AP. 3 cm. Signal Generators type TS.13/AP, 10 cm. Signal Generators type TS.14/AP., Millivoltmeters, Valve Voltmeters, Audio Frequency Oscillators by Hewlett Packard Type 205 AG. Receivers type AR.88LF, S.27 etc. Magnetrons type 2J.51, Klystrons type 723 A/B.

Microphotometers, Chart recorders to your specification.



SIGNAL GENERATOR TYPE TF.390G

WE CAN ALSO UNDERTAKE TO RECALIBRATE OR REBUILD YOUR LABORATORY EQUIPMENT.

For further particulars of these and other high grade electronic instruments, write to:—

HATFIELD INSTRUMENTS LTD. **175, UXBRIDGE ROAD HANWELL, LONDON, W.7**

Telephone: EALing 0779, 9857

Recondition

a C.R.T.?

Certainly–

if it's an 'English Electric' T901A*

Every home constructor will appreciate ' English Electric's ' unique C.R. Tube Reconditioning Service. It means that when your C.R.T. ceases to work, you can, if it's an 'English Electric' metal tube in physically sound condition, take it to your dealer and exchange it for a good-as-new and guaranteed one—for £12. A nice little saving of £10 for you.

Write to 'English Electric' for a complete specification of the T901A the finest tube that any constructor can buy, and you have started saving money right away.

**The tube specified by the designers of the 'Tele-King', 'Magnaview' and 'Super-Visor' circuits and 'Viewmaster' conversion circuit.*

'ENGLISH ELECTRIC' T901A

THE BRITISH MADE LONG-LIFE RECONDITIONABLE TUBE

If you have any difficulty in obtaining supplies write to:

The ENGLISH ELECTRIC Company Limited, Television Department, Queens House, Kingsway, London, W.C.2

Industry is Solving Valve Testing Problems

WITH THE

Mullard HIGH SPEED VALVE TESTER

Industries which deal extensively with radio and other electronic equipment are finding the Mullard High Speed Electronic Valve Tester ideal for routine checks. This instrument provides the quickest method of checking large quantities of valves, and can be operated if necessary by non-technical personnel after only a few minutes' instruction.
Write for full details and a copy of the folder "High Speed Testing in Industry" to Department E.V.D. at the address below.

Mullard

MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, W.C.2

MVM266A

NEW ARCOLECTRIC SIGNAL LAMPS

For Low Voltage or Mains

Illustrated are a few signal lamps taken from our wide range. The insulation of every Arcolectric signal lamp will resist a flash test of 1,500 volts A.C.
The S.L.90 illustrated here is a typical Arcolectric low voltage signal lampholder. It is designed to accept popular M.E.S. bulbs. The bulb is accessible from front or rear of panel. The domed plastic lens surrounded by a polished chrome bezel gives a most attractive panel appearance. This holder can be fixed in a single ¾" hole.
The mains voltage signal lamp S.L.88/N is supplied complete with an M.E.S. neon tube and a suitable series resistance.

Write for Catalogue No. 128

S.L.88/N

S.L.90

S.L.86

S.L.82

S.L.92

ARCOLECTRIC SWITCHES · LTD

CENTRAL AVENUE, WEST MOLESEY, SURREY · TELEPHONE: MOLESEY 4336 (3 LINES)

R&A

Loud-speaker Manufacturers to the radio industry since 1930

We do wonder

. . . whether all our friends who like R. & A. Reproducers remember that we also make output transformers and audio frequency chokes which are just as good—to the same rigid standards of design, production, and inspection, and with the same insistence upon meeting delivery promises.

We don't suggest that radio and television manufacturers are unable to make such components for themselves; but as they have so many other problems which can be solved only in their own works, there is a good case for passing on some of those which can be handled reliably and economically elsewhere.

REPRODUCERS AND AMPLIFIERS LIMITED
WOLVERHAMPTON ENGLAND

Telephone : Wolverhampton 22241 (5 lines)
Telegrams : Audio, Wolverhampton

NEW IMPRESSION NOW READY

Edited by F. Langford-Smith, B.Sc., B.E. Senior Member I.R.E. (U.S.A.), A.M.I.E. (Aust.)

Radio Designer's Handbook

The first impression of this greatly enlarged fourth edition sold out within a few weeks of publication and a second impression has been produced to meet the enormous demand.

Radio Designer's Handbook is a comprehensive reference book, the work of 10 authors and 23 collaborating engineers, containing a vast amount of data in a readily accessible form. The book is intended especially for those interested in the design and application of radio receivers or audio amplifiers. Television, radio transmission and industrial electronics have been excluded in order to limit the work to a reasonable size.

8¾" × 5½" 1,522 pages

42s. net. By post 43s. 6d.

This book must not be distributed to Australia, New Zealand or the Americas.

Published for "WIRELESS WORLD"

From booksellers or from: Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1

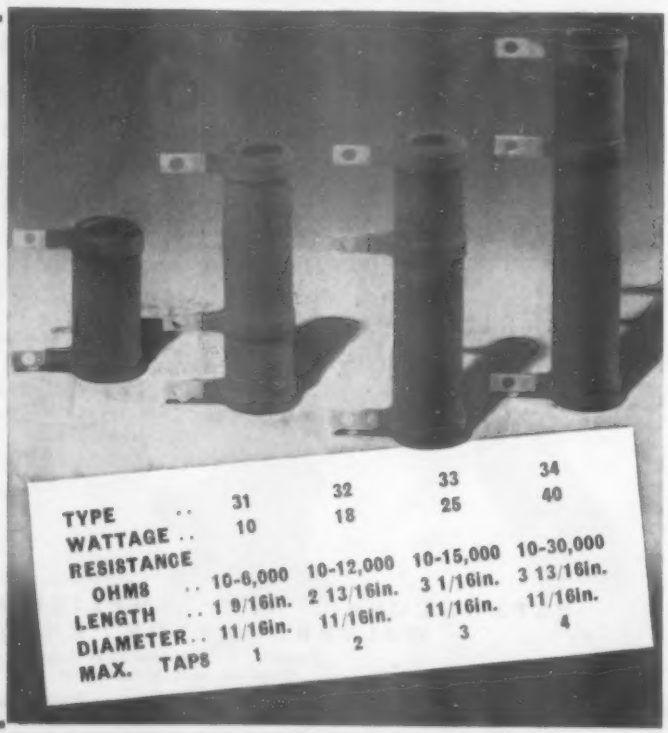
RM

POWER RESISTORS

Coated with a non-hygroscopic and fireproof silicone bonded compound. Internal connections made by special method of welding, giving long-term stability under all conditions.

Standard range is shown but we shall be pleased to advise on special types to suit particular requirements.

R. M. ELECTRIC LTD.
TEAM VALLEY, GATESHEAD, 11
Tel: Low Fell 76057

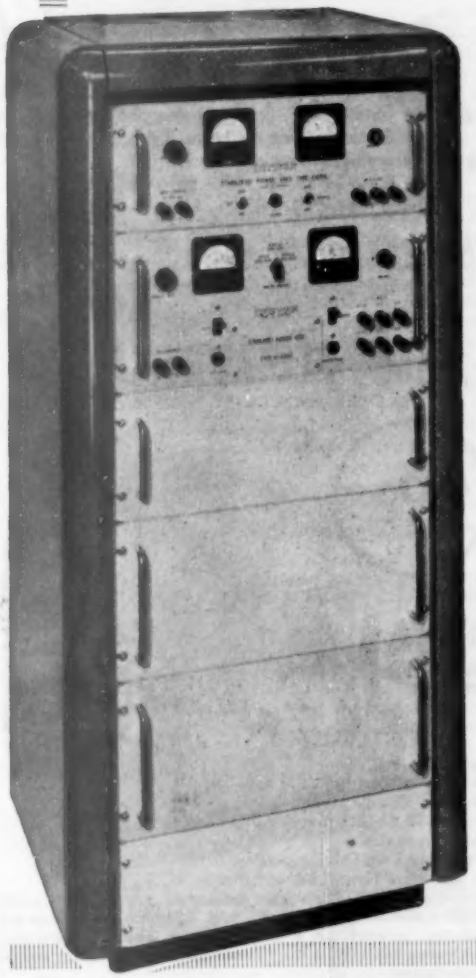


TYPE	31	32	33	34
WATTAGE	10	18	25	40
RESISTANCE OHMS	10-6,000	10-12,000	10-15,000	10-30,000
LENGTH	1 9/16in.	2 13/16in.	3 1/16in.	3 13/16in.
DIAMETER	11/16in.	11/16in.	11/16in.	11/16in.
MAX. TAPS	1	2	3	4

EDISWAN

Stabilised Power Supply Units

Staffs of Electrical and Electronic Laboratories and Test Rooms frequently design and construct their own units for supplying stabilised D.C. power; but for most general needs it is cheaper and more satisfactory to purchase an Ediswan Unit. Type R.1095 covers the range 120-250 volts, and type R.1103 250-400 volts. Both units work from A.C. mains supply and are designed for standard 19" rack mounting or for bench use. Meters are included.



PRICES

R.1095	£27 - 10 - 0
R.1103	£57 - 0 - 0

Full details on request

BRIEF SPECIFICATIONS

Type R.1095

Input.	200-250 volts, 40-100 c.p.s.
Output.	High stability, D.C. output 120-250 volts at 0-50 mA and an unstabilised 6.3v. A.C. 3 amp. heater supply.
Stability.	A 10v. change in mains input results in an output change of less than 0.15 volts. A change from zero to full load results in an output change of less than 0.15 volts.
Output Resistance.	Less than 3 ohms.
Ripple.	Approximately 2mV R.M.S.
Output Circuits.	All circuits isolated from earth. Heater supply can be operated at up to 500 volts from earth.
Mounting.	The unit is designed for standard rack mounting or for bench use. Plated bench stands are available if required.

Type R.1103

Input.	200-250 volts, 40-100 c.p.s.
Output.	High stability, D.C. output 250-400 volts, adjustable in three ranges. Maximum load is 200 mA up to 350 volts and 150 mA from 350 volts to 400 volts. In addition two unstabilised 6.3 volt A.C. heater supplies are provided.
Stability.	A 10 volt change in mains input voltage results in an output change of less than 0.15 volts. A change from zero to full loads results in an output change of less than 0.4 volts.
Output Resistance.	Less than 2 ohms.
Ripple.	Approximately 5mV R.M.S.
Output Circuits.	All circuits isolated from earth. Heater supply can be operated at up to 500 volts from earth.
Mounting.	The unit is designed for standard rack mounting, or bench use.

Illustration shows Ediswan Stabilised Power Supply Units type R.1095 and R.1103, rack mounted.

THE EDISON SWAN ELECTRIC CO. LTD. 155 CHARING CROSS ROAD, LONDON, W.C.2

Telephone: Gerrard 8660 · *Member of the A.E.I. Group of Companies* · Telegrams: Ediswan Westcent, London

RP114

The **smallest precision soldering instrument** you've ever seen!

(ACTUAL SIZE)

- No fatigue . . . as light and easy to use as a pencil (¼ oz.)
- Speeds production . . . heats up in 30 seconds.
- Safety first . . . for 6, 12 or 24 volts.
- Prevents damage . . . pin-point heat concentration for small assemblies.
- Robust construction . . . no ceramic or mica formers to break or flake.
- Fully reliable . . . in constant demand by the world's most famous manufacturers.
- 5 MODELS, designed for production line assemblies from hairspring to radio chassis capacity.

Model	Wattage	Bit-size	Voltage
12	12	1/8"	6, 12, 24 or 50
9	8.3	1/16"	6, 12 or 24
6A	6	1/32"	6 volts only
6	6	1/16"	6 " "
11*	10	1/32"	6 " "

* *Special high temperature model—solder temperature 300°C*

ORYX

MINIATURE SOLDERING INSTRUMENTS

Sole Distributors:

ANTEX · 3 Tower Hill · London · E.C.3

Telephone: ROYal 4439

Accepted as the Standard..

. . . by leading manufacturers, the trade and the aircraft industry.

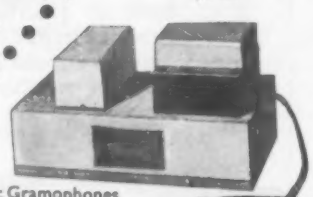
Valradio

DC/AC CONVERTERS

Units Complete and ready for use

Specialists in Converters since 1937

Please ask for our descriptive folder W.W.



- for Electric Gramophones from £8 16s. 0d.
- for Radios, Radiograms, and Autochange Radiograms (inc. 3-speed motors) from £11 16s. 6d.
- for Television, Tape Recorders, and for operation of TV from Country House lighting plants, price according to Instrument.
- Inputs, 6, 12, 24, 32, 50, 110 or 200/250V. D.C.
- Outputs, 110V. or 230V. 50 or 60 c/s.

VALRADIO LTD. NEW CHAPEL ROAD, HIGH STREET FELTHAM, MIDDX. Tel.: FELtham 4242

Service Dept.: 57 Fortess Road, London, N.W.5 GULliver 5165 and 7202

Overseas enquiries to nearest E.M.I. Organisation Depot

the "ELIZABETHAN"

TWO SPEED, PORTABLE TAPE RECORDER

48 GNS. *Complete with mike and tape*

FILTERCELL MICROPHONE

PUSH-BUTTON CONTROLS

The "Elizabethan" has been designed with one aim in mind — *accurate* sound reproduction. Wherever you use the "Elizabethan" . . . in the home, concert hall or jazz club . . . every recording will acclaim its astounding success. Each sound will be reproduced faithfully and with an authenticity of tone and range that, hitherto, only a more expensive instrument could give. Most leading dealers stock the "Elizabethan" and will gladly arrange a demonstration.

For illustrated leaflet write to:

EAP **(Tape Recorders) LIMITED**

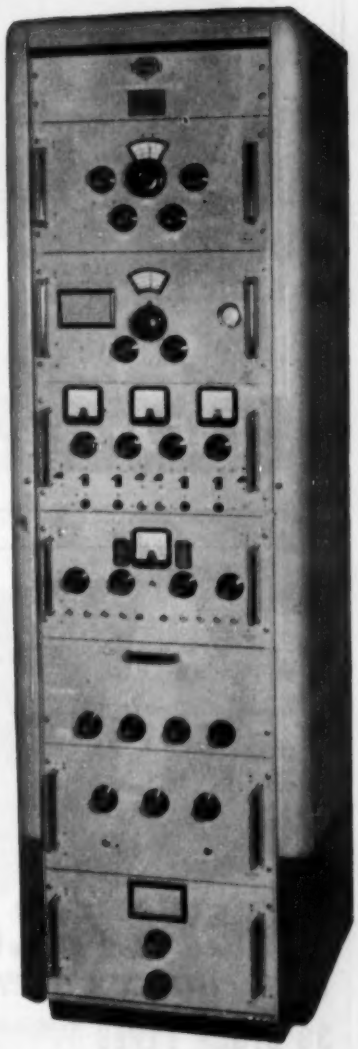
546 Kingsland Rd., London, E.8.

Telephone: CLI. 7586

a new

INDEPENDENT SIDEBAND RECEIVER

. . . developed to British Post Office Specification



THIS new Independent Sideband Receiver type GFR 552 is designed for operation on long-distance, point-to-point, short-wave radio links forming part of the international trunk network. On independent sideband working, the GFR 552 provides facilities for the reception of two single sideband signals, each 6 kc/s wide, one above and one below the frequency of a reduced-level pilot carrier. Each sideband will accommodate either two 3 kc/s wide telephony channels, or several voice frequency telegraph channels. The GFR 552 may also be used for reception of single sideband or double sideband transmission. In the case of the second application this receiver offers two advantages: firstly, the absence of non-linear distortion which occurs in normal d.s.b. receivers when signals are subjected to selective fading conditions; and, secondly, the ability to select upper or lower sideband for demodulation, dependent upon which is freer from adjacent channel interference.

The circuit and chassis layout of the GFR 552 closely follows that of the Mullard Receiver GFR 551, which was based on a British Post Office design (Receiver, Radio No. 22).

Special features of the GFR 552 include a high order of oscillator stability and freedom from cross-modulation through which cross-talk between channels or inter-modulation between wanted and unwanted signals might occur. A brief technical summary is given below. More detailed information supplied on request.

FREQUENCY RANGE—*4-30 Mc/s.*
NOISE FACTOR—*better than 7 dB over the band.*
SIGNAL TO NOISE RATIO—*25 dB for 4 microvolts peak sideband input over the band.*
SELECTIVITY—*The response is flat within 2 dB for sideband frequencies between 100 c/s and 6000 c/s. At 10 kc/s from the carrier frequency the response is —60 dB relative to the pass band.*
A.F.C.—*The a.f.c. system operates effectively with a pilot carrier level of —26 dB relative to 1 microvolt (which corresponds to a peak sideband level of 1 microvolt and a signal to noise ratio of 15 dB).*
NON-LINEAR DISTORTION—*Third order intermodulation products which might result in cross talk between sidebands do not exceed —50 dB relative to the sideband levels.*
OUTPUT—*Variable up to +14 dB relative to 1 mW into 600 ohms.*

Mullard

SPECIALISED ELECTRONIC EQUIPMENT

MULLARD LIMITED, EQUIPMENT DIVISION, CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2
(M1417)

THIS CASE | *IS ONE OF OUR 1072 SERIES*

reg. des. app. no. 870811

It is robustly constructed and has excellent ventilation.

Front panels of 10 S.W.G. steel bolt to standard G.P.O. drillings and it is supplied with chassis runners and cast inset handles.

It is one of our new range of standard metal cabinets, cases, racks and desks.

SEND TO DEPT. A
for illustrated catalogue
of our standard range

IMHOFS

112-116 NEW OXFORD STREET, LONDON, W.C.1
MUSeum 7878

CO-AX

* **ULTRA LOW**
capacitance & attenuation

38 STOCK TYPES
for your
STANDARD or SPECIAL
APPLICATIONS

TYPE	μμF/ft	IMPED.Ω	O.D.
C 1	7.3	150	.36
C 11	6.3	173	.36
C 2	6.3	171	.44
C 22	5.5	184	.44
C 3	5.4	197	.64
C 33	4.8	220	.64
C 4	4.6	229	1.03
C 44	4.1	252	1.03

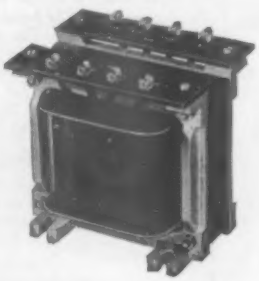
U.Q. CONNECTORS—R.G. CABLES

TRANSRADIO LTD. 138A Cromwell Rd. London SW7. Tel: FRE.4421

STL

TRANSFORMERS
for POWER SUPPLIES and AUDIO FREQUENCY
Chokes for A.C. and D.C.

Suitable for use in all electrical and electronic equipment, to Ministry, B.S.S. or commercial standards. Tropical or standard finish.



Enquiries from manufacturers and the trade only.
Quotations sent upon receipt of specifications or drawings.

STEWART TRANSFORMERS Ltd.
75 KILBURN LANE, LONDON, W.10
Tel: LADbroke 2296

Output Level Stabilised to ±½db

OVER THE FULL FREQUENCY RANGE OF 10 Kc/s — 10 Mc/s

An outstanding feature of the Wayne Kerr Video Oscillator Type O.222A is a thermistor bridge circuit stabilising the amplitude. Once set the output level will remain constant within 0.5 db while the oscillator frequency is varied over its full range of 10 Kc/s to 10 Mc/s. *Another advantage* is its special facility for indicating the modulus of the load impedance to which the instrument is connected.

SPECIFICATION

In transportable case £155, *or for standard* 19" *Rack mounting* £148.

Frequency Range:	10 Kc/s — 10 Mc/s in 6 ranges
Frequency Stability:	better than 1 in 10^5 in 1 hour
Frequency Accuracy:	1%
Output Range:	+10 db to −50 db on 1V p-p.
Output Level:	Constant to ±0.5 db at any frequency (setting
Output Impedance:	75 ohms
Total Harmonic Content:	less than 1%

Wayne Kerr

THE WAYNE KERR LABORATORIES LTD · NEW MALDEN · SURREY

A REMINDER . . . .

Deflector Coils type DC300/C. As specified for the "Teleking," "Supervisor" and "Magnaview."

Conversion circuits for 14in. and 17in. C.R. Tubes now available.

Since we pioneered wide-angle scanning for the Home-Constructor several years ago, we have become so well-known as manufacturers of reliable television components that some of our standard lines are liable to be forgotten.

Typical examples of these are:—

465 kc/s I.F. Transformers, type 160 (Miniature) size 1in. x 1in. x 2in. Price **7/6** each.

465 kc/s I.F. Transformers, type 158 (Standard) size 1⅞in. x 1⅞in. 3½in. Price **9/6** each.

Tape-Deck Oscillator Coils, type 31. High impedance, screened, each coil adjusted to 9 mH. Price **9/3** each.

From all Leading Stockists.

ALLEN COMPONENTS LIMITED

Crown Works, Lower Richmond Rd., Richmond, Surrey

Telephone: Prospect 9013

Send 9d. and S.A.E. for Wide-Angle Circuit Diagrams

Actual Size

NEW!

The Manning-Carr Miniature Polarised Relay

DATA—A Sensitivity of 25 milli-watts and capable of handling mains voltage on the contacts with alternating currents up to 0.25 amps. Being polarised it has the advantage that the Armature contact can be biased to lock in either direction by suitable adjustment of the contact screws, which provides a useful facility where pulse operation is required. Speed of operation is also high and the Relay will follow A.C. frequency of 50 c.p.s. Resistance up to 8,000 ohms, which is acceptable for Anode circuits. Alternatives to specification if required. *Sole Concessionaires.*

POST OFFICE TYPES 3,000 AND 600 RELAYS

to specification. Tropicalising, Impregnating and Services jungle finish if required. Delivery 3-4 weeks.

Manufacturers to H.M. Govt. Depts. and leading contractors

L. E. SIMMONDS LTD.

5, BYRON ROAD, HARROW, MIDDX.

Telephone: Harrow 2524—0313.

CELSONIC

TAPE RECORDERS WILL RECORD 3250ft. of TAPE to give **85 Minutes** continuous playing

Enthusiasts are enthusiastic

Listen why **CELSONIC** Recorders are better.

A flat response from 50-10,000 cps to within ± 2 dbs. Fitted with superimposing device, e.g., will record words on top of music. Automatic synchronising unit for use with cine projector. Celsonic recorders are the best where high-fidelity reproduction is required.

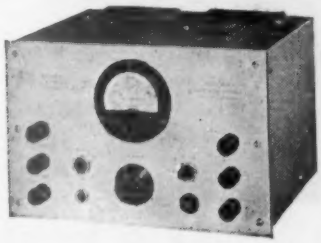
Write for illustrated leaflet to:

EXCEL SOUND SERVICES LTD.

"CELSONIC" WORKS, GARFIELD AVE., BRADFORD, 8 (Yorks)

Telephone: **BRADFORD 45027**

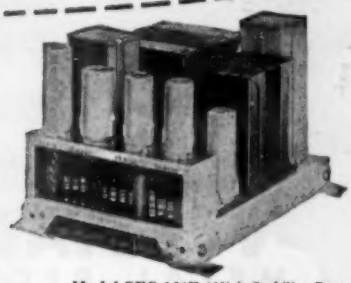
FOR POWER SUPPLIES



Model SRS 153 (*Solartron Vari Pack*)

D.C. Output Voltage:	0-500 volts positive or negative.
D.C. Output Current:	100 m/a up to 350 volts. 50 m/a. up to 450 volts.
A.C. Output:	4 or 6.3 volts at 3 amps.
Ripple:	0.2 volt maximum.

Price £33

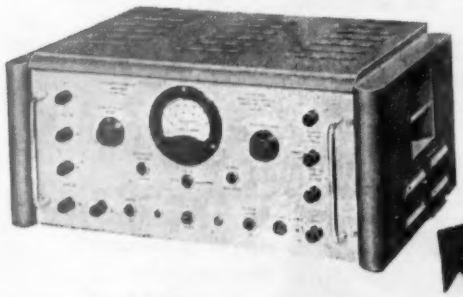


Model SRS 154B (*High Stability Power Unit*)

D.C. Output Voltage:	250 volts +Ve or —Ve, 0-50 m/a.
Stabilisation:	0.025% for a ±10% mains change.
D.C. Resistance:	0.5 ohm.
A.C. Impedance:	0.05 ohm from 40 c/s to 100 Kc/s.

Ripple and Noise Content. Less than 200 microvolts.

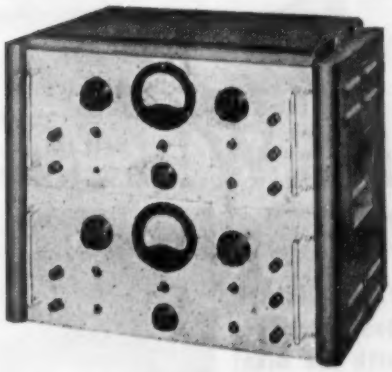
Price £30



Model SRS 151A (*Regulated Power Supply*)

D.C. Output:	20-500 volts +Ve or —Ve, 0-300 m/a.
Stabilisation:	1 part in 400 for ±10% mains change.
Source Impedance:	3 ohms.
Hum Level:	8 millivolts maximum.
A.C. Output:	Two 6.3 volt outputs at 5 amps.

Price £104



Model SRS 152 (*Twin Regulated Power Supply*)

D.C. Output Parallel Condition:	0-500 volts +Ve or —Ve, 0-300 m/a.
D.C. Output Series Condition:	0-1000 volts +Ve or —Ve, 0-150 m/a. or 0-500 volts +Ve and 0-500 volts —Ve.
Stabilisation:	0.2% for a ±10% mains input change.
Ripple:	Less than 8 millivolts.
A.C. Output:	Two 6.3 volt outputs at 5 amps.

Price £165

SPECIFY

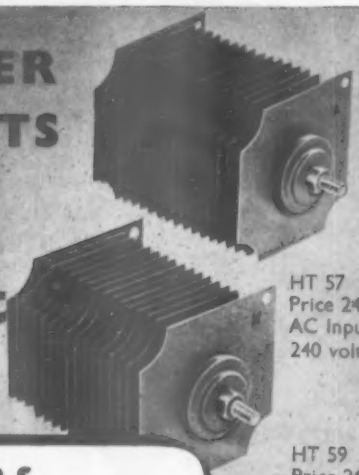
SOLARTRON

Write for full detail of the Solartron ranges of instuments.

SOLARTRON LABORATORY INSTRUMENTS LIMITED,
Solartron Works Thames Ditton Surrey Tel: Emberbrook 5611

New RECTIFIER DEVELOPMENTS

for TELEVISION ANODE SUPPLIES and at less cost



HT 57
Price 24/3
AC Input
240 volts.

HT 59
Price 26/3
AC Input
250 volts.

WESTINGHOUSE

WESTALITE METAL RECTIFIERS

These new "Westalite" rectifiers are the answer to every problem confronting the amateur television constructor, either for building into new sets or as replacements. Everything about them is right—price—size—output—efficiency—and, of course, reliability; and they will provide a current output of 300 mA, providing that cabinet and circuit conditions allow adequate ventilation. They are for use in conventional half-wave circuits, and are available EX STOCK. Address all enquiries to

DEPT. W.W.7., WESTINGHOUSE BRAKE & SIGNAL CO. LTD.
82 York Way, King's Cross, London, N.1

NEW! PORTABLE OSCILLOSCOPE

TYPE 2300
(Industrial Electronics)

The Miniature Oscilloscope with the Giant Specification

- ★ Direct-coupled X and Y amplifiers
- ★ D.C. to 3 Mc/s frequency response
- ★ Size: 7¼" × 4¾" × 7½"
- ★ Weight: 6½ lbs.
- ★ 5c/s to 50kc/s time-base with a trace expansion control from zero to 15"
- ★ 2¾" effective screen diameter

SEND NOW FOR DETAILS

SOLE DISTRIBUTOR—
G. A. STANLEY PALMER A.R.Ae.S., MAXWELL HOUSE
ARUNDEL ST., STRAND, LONDON, W.C.2. TEM. Bar 1810

hydraulically formed

BY A PROCESS UNIQUE IN THIS COUNTRY

COMBINING THE PROPERTIES OF

1. A compression spring capable of repeated flexing
2. A container which can be hermetically sealed
3. A packless gland

for Automatic coolant regulation: Movement for pressure change: Packless gland to seal spindle in high vacua: Reservoir to accept liquid expansion: Dashpot or delay device: Barometric measurement or control: Pressurised couplings where vibration or movement is present: Dust seal to prevent ingress of dirt: Pressure reducing valves: Hydraulic transmission: Distance thermostatic control: Low torque flexible coupling: Pressure sealed rocking movement: Pressurised rotating shaft seals: Aircraft pressurised cabin control: Refrigeration expansion valves: Thermostatic Steam Traps: Pressure amplifiers: Differential pressure measurements: Thermostatic operation of louvre or damper.

Write for List No. N.800-1 B13

DRAYTON metal bellows

The Drayton Regulator and Instrument Co. Ltd., West Drayton, Middlesex

The new Mk. III Camera with 4½" or 3" image orthicon tube . . .

The use of the new Marconi camera BD 687 with 4½" or 3" image orthicon tube and the employment of better circuit techniques in the camera channels have reduced to a negligible degree such faults as black halos, edge effects and electronic ghosts; whilst resolution, grey scale and signal-to-noise ratios are greatly improved. Ingenious design has led to simplicity of control and provided for fully remotely controlled applications.

Besides the camera the channels BD 808/809 comprise a Camera Control and Preview Monitor, Regulated Power Supply Unit and Focus Supply Unit.

MARCONI

Complete Broadcasting and Television Systems

Marconi equipment has been installed in every one of the BBC Television transmitter stations and in the USA, South America, Canada, Italy and Thailand.

MARCONI'S WIRELESS TELEGRAPH CO. LTD., CHELMSFORD, ESSEX

LB 1

D

Buy your American Type Valve$ for Sterling...

The wide range of **BRIMAR VALVES** is now readily available throughout the world. Combining cost-saving techniques with craftsmanship precision, **BRIMAR** American type valves are amongst the finest obtainable in either hemisphere.

More and more the world's governments . . . . set makers . . . . laboratories are standardizing on American types, valves which are obtainable anywhere in the world, valves which you can get from **BRIMAR** without expending dollars.

Efficient . . . . reliable . . . . robust . . . . **BRIMAR VALVES** are chosen for radio and electronic equipments in the fighting services and throughout industry. Their rugged dependability can contribute so much to your own products.

THE **BRIMAR** RANGE IS

the RANGE that is **RELIABLE**
the RANGE that is **ROBUST**
the RANGE **YOU REQUIRE**

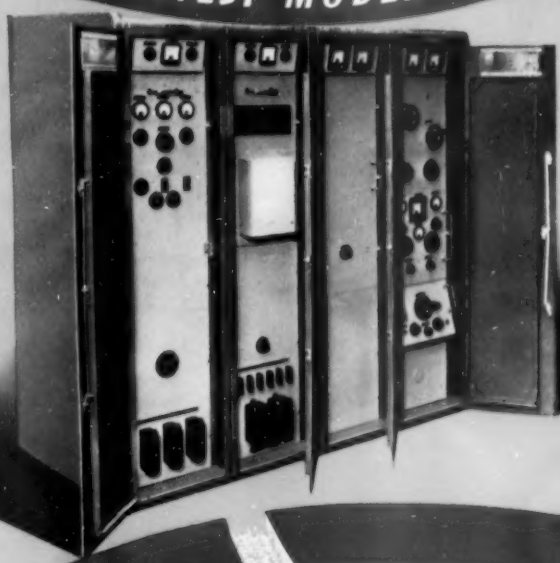
BRIMAR everywhere the Valve of Value

Dependable

BRIMAR RADIO VALVES

Standard Telephones and Cables Limited **FOOTSCRAY, SIDCUP, KENT, ENGLAND**

In the service of BRITAIN'S FASTEST MODERN AIRCRAFT



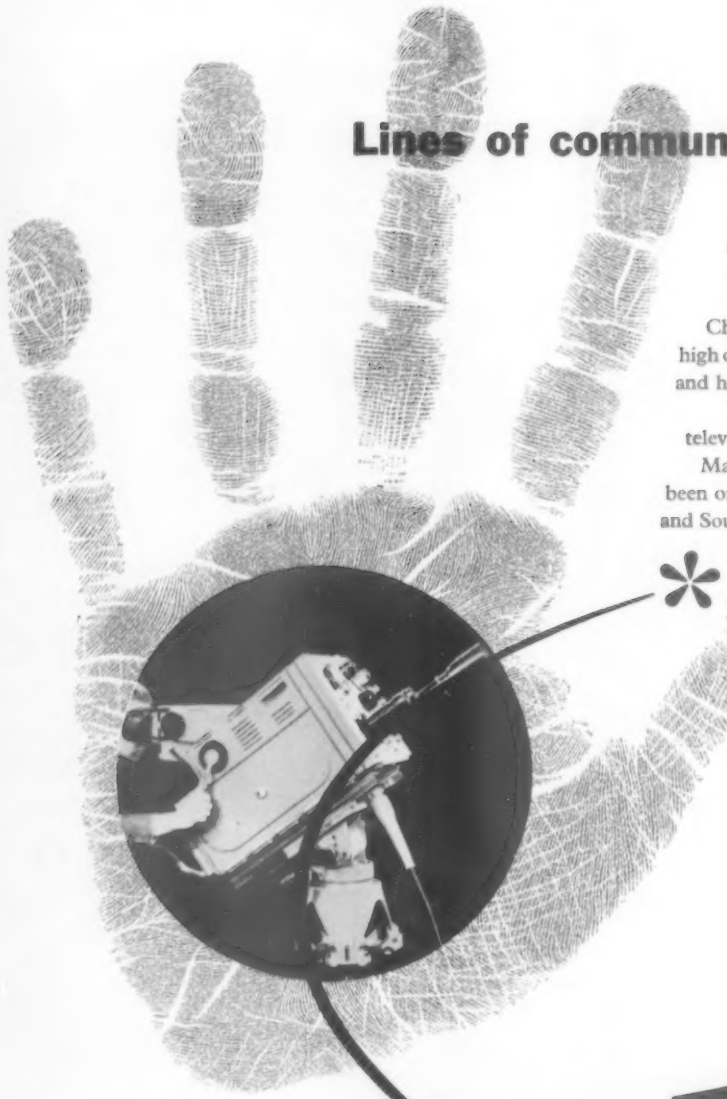
With long range beacon services for International air routes installed at many key points on the new Empire routes . . . the Redifon G.91 and its HF equivalent G.67, are providing navigational communication and inter-stage teleprinter services for Britain's latest high speed aircraft.

Redifon

Aviation Communications Division
REDIFON LIMITED, BROOMHILL ROAD, LONDON, S.W.18, ENGLAND, VANdyke 7281
A Manufacturing Company in the Rediffusion Group

Lines of communication . . .

In June 1920 the first advertised sound radio programme was broadcast from the Marconi transmitter at Chelmsford. To-day Marconi high or medium power transmitters and high power aerials are installed in every one of the B.B.C's television transmitter stations and Marconi television systems have been ordered for countries in North and South America, Europe and Asia.



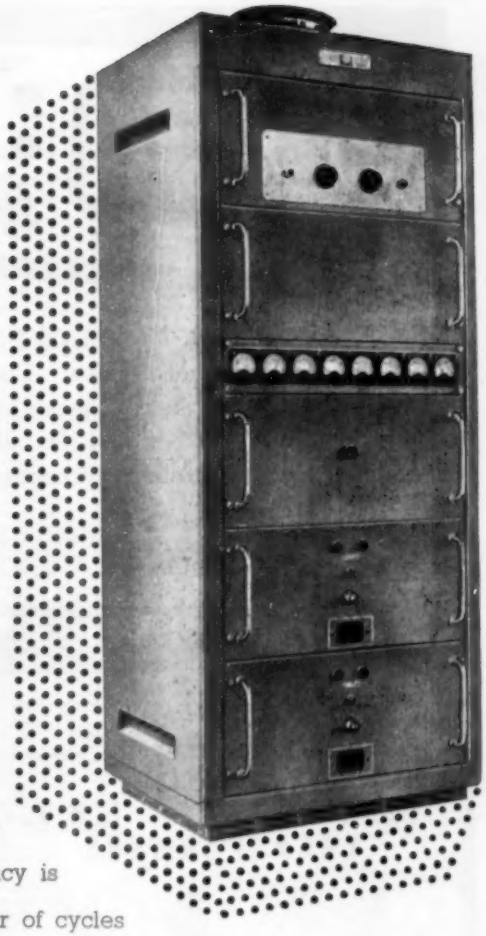
TELEVISION CAMERAS
SOUND AND VISION STUDIO EQUIPMENT
RADIO LINKS AND TRANSMITTERS
AERIAL SYSTEMS

MARCONI

Complete Television and Sound Broadcasting Systems

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED · CHELMSFORD · ESSEX

LG 1



AUTOMATIC FREQUENCY MONITOR (20 Mc/s)

Designed for the measurement of any frequency in the range 10 c/s to 20 Mc/s with a basic accuracy of ± 1 part in 10^6 ± 0.1, 1.0, or 10 c/s. Higher accuracies available if required. The unknown frequency is determined by counting the number of cycles that pass through a 'gate' open for a selectable time interval of 0.1, 1.0, or 10 seconds. The result is presented on eight panel mounted meters each scaled 0 to 9 and is in decimal notation. Full information available on request.

CINEMA-TELEVISION LIMITED

A Company within the J. Arthur Rank Organisation

WORSLEY BRIDGE ROAD · LONDON · SE26

Telephone HITher Green 4600

SALES AND SERVICING AGENTS

F. C. Robinson & Partners Ltd., 287 Deansgate, Manchester, 3

Hawnt & Co., Ltd., 89 Moor St. Birmingham, 4

Atkins, Robertson & Whiteford Ltd. 100 Torriedale Street, Glasgow, S.2

THE
Chronotron

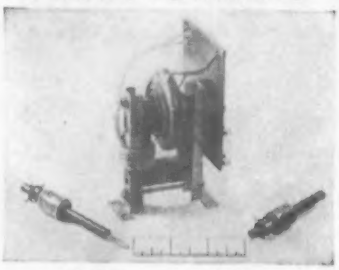
A direct reading electronic stop clock for general purpose timing in the millisecond and microsecond regions. The CHRONOTRON is used for timing relays and fuses; speeds of vehicles and projectiles; for testing camera shutters and for physiological investigations. Timing can be controlled by contacts, by a photocell, or by external voltages.

E·I·L

MODEL 25A	MODEL 25B	MODEL 25C
0–4 milliseconds to 0–1 second	0–40 milliseconds to 0–10 seconds	0–40 microseconds to 0–10 milliseconds

ELECTRONIC INSTRUMENTS LTD
RICHMOND · SURREY · ENGLAND RICHMOND 5656

"WEYRAD"
LINE FLYBACK E.H.T. TRANSFORMERS



TYPE . . . . . L.F.B.2.

High efficiency auto-wound transformer with Ferrite core. Provision is made for the use of either 6 or 30 millihenry line coils. A maximum output of 15 kV is obtained with a 195 v. H.T. line. A reduction to 175 v. H.T. gives 13.5 kV output.

Retail price 33/-

WIDTH AND LINEARITY CONTROLS (TYPE 2) FOR USE WITH THE ABOVE TRANSFORMER

Width Control 7/-
Linearity Control 7/9

WEYMOUTH RADIO MFG. CO., LTD.,
CRESCENT ST., WEYMOUTH, DORSET.

Quartz Crystals of any shape and size cut and ground precisely to specification and coated, if required, with Gold, Silver, Aluminium or Rhodium, etc.

BROOKES CRYSTALS LTD.
Suppliers to Ministry of Supply, Home Office, B.B.C., etc.
EARLSWOOD STREET, GREENWICH, LONDON, S.E.10
Phone: Greenwich 1828
Grams: Xtals Green, London. *Cables:* Xtals, London

CLASSIC EXAMPLES of HIGH-FIDELITY EQUIPMENT and COMPONENTS

If it's the *latest* model in the Hi-Fi field, then Classic are the people most likely to have it *in stock*. Such up-to-the-minute apparatus as the NEW Leak amplifier, the NEW Leak pick-up, the NEW Lowther speaker and the NEW Connoisseur pick-up are here for your inspection. Whatever it is, if it's new, then Classic—the specialists—have it, both for Recording and Hi-Fi.

LOUDSPEAKERS AVAILABLE FROM STOCK AND WIRED FOR DIRECT COMPARISON ON ANY ONE OF SIX OF THE LEADING MAKES OF AMPLIFIERS. HEAR YOUR FAVOURITE LOUDSPEAKER ON ANY AMPLIFIER.

LOUDSPEAKERS HI-FI

	Cash Price	Credit Sale 0 Equal P'mts. of:	Hire Purchase Deposit	Hire Purchase 12 P'mts. of:
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Vitavox Klipshorn	145 0 0	17 11 6	50 0 0	9 11 8
Lowther Type PM3	96 0 0	11 14 7	32 0 0	6 2 8
Acoustical Corner Ribbon	95 0 0	11 12 3	32 0 0	6 0 0
Wharfedale "Triune"	96 0 0	11 14 7	32 0 0	6 2 8
Wharfedale Corner	72 0 0	8 16 0	24 0 0	4 12 0
Tannoy 15in. dual concentric	33 10 0	4 2 0	11 10 0	2 19 0
Tannoy 12in. dual concentric	27 10 0	3 6 0	9 10 0	1 14 6
Lowther PW1 (walnut)	78 10 0	9 12 0	26 10 0	5 0 0
Goodmans Axiom 22 (in recommended reflex cabinet)	37 14 0	4 12 3	12 14 0	2 7 0
Goodmans 150 in Corner Baffle	22 17 0	2 16 0	7 17 0	1 8 9
Wharfedale Super 12/CS/AL in Classic Reflex cabinet	38 10 0	4 14 3	12 10 0	2 10 0
Wharfedale W/10. CSB Corner Baff. Assembly	24 16 0	3 4 0	8 16 0	1 10 8

COMPLETE WHARFEDALE AND GOODMANS AND W.B. RANGE NORMALLY STOCKED.

LOUDSPEAKER & CORNER REFLEX CABINETS & BAFFLES

Goodmans Audiom 60 or Axiom 150. Exactly to spec.	19 10 0	2 7 9	6 10 0	1 5 0
Goodmans Axiom 150 or Axiom 22. Large size	25 0 0	3 1 0	8 10 0	1 11 8
Classic Contemporary Bass Reflex Cabinet in oak or walnut, takes any 12in. unit	21 0 0	2 11 4	7 0 0	1 6 10
Classic Bass Reflex Corner Baffle, oak or walnut, takes any 12in. unit	18 0 0	2 4 5	6 0 0	1 3 4
Wharfedale Corner Baffle takes W/10/CSB	12 10 0	1 12 3	4 10 0	15 4

RADIO FEEDER UNITS F/M

Lowther	22	0	0	2	13	8	7	10	0	1	7	8
Chapman	18	10	0	2	5	7	6	2	0	1	4	0
Goodsell	15	0	0	1	8	0	5	0	0	1	0	0

AT LAST—now you can believe your own ears—come and hear *your* choice of 6 of the latest amplifiers fed into any of 12 of the finest speakers in the world at the Classic Demonstration Studio—just another part of the Classic Service for the Hi-Fi enthusiast.

AMPLIFIERS HI-FI

	Cash Price	Credit Sale 0 Equal P'mts. of:	Hire Purchase Deposit	Hire Purchase 12 P'mts. of:
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Goodsell Williamson C. core	40 4 0	4 18 4	13 14 0	2 10 0
Goodsell Std. Williamson	36 0 0	4 8 0	12 0 0	2 6 0
Pye PF.9 and PF.19a	42 0 0	5 2 7	14 0 0	2 13 8
Leak TL.12	28 19 0	3 10 9	9 19 0	1 16 5
Leak TL.10	17 17 0	2 4 2	5 17 0	1 3 4
Quad Mark II	22 1 0	2 14 0	7 15 0	1 7 6
Rogers Senior	28 0 0	3 8 6	9 10 0	1 15 4
Rogers Baby de Luxe	14 10 0	1 17 0	4 10 0	1 0 0
Goodsell MA.5	13 10 0	1 4 6	4 10 0	18 4
Goodsell MA.5 ultra lin.	14 10 0	1 17 0	4 10 0	1 0 0
Armstrong A.10	19 15 0	2 8 4	6 15 0	1 5 0
Connoisseur	27 10 0	2 7 4	9 10 0	1 14 6

PICKUPS—PICKUP HEADS—ARMS

Lowther Diamond L.P.	21	17	10	2	13	4	7	17	10	1	6	10
Lowther Diamond Std.	21	17	10	2	13	4	7	17	10	1	6	10
Lowther Sapphire L.P.	9	9	0	1	3	4	—			—		
Lowther Sapphire Std.	9	9	0	1	3	4	—			—		
Leak Pickup Arm	3	14	3									
Leak Diamond L.P. Head	7	15	3	2	7	6	6	4	9	1	5	0
Leak Diamond Std. Head	7	15	3									
Connoisseur Pickup Arm	2	11	0									
Connoisseur Diamond L.P.	7	8	11	2	3	4	6	8	10	1	1	8
Connoisseur Diamond Std.	7	8	11									
Acos Hi-G Arm	1	1	9									
Acos Hi-G 39/1 L.P.	2	2	3	14	2		—			—		
Acos Hi-G 39/2 Std.	2	2	3									
Decca Arm	1	5	0									
Decca Diamond Std.	5	19	1	1	16	4	4	2	10	1	0	0
Decca Diamond L.P.	6	18	9									
Decca Pickup Arm	1	5	0									
Decca Sapphire L.P.	2	15	0	17	2		—			—		
Decca Sapphire Std.	2	15	0									
Decca 'H' Type Diamond L.P.	6	18	9	17	7		—			—		

RADIO FEEDER UNITS A/M

Lowther D.T.5	44	0	0	5	7	7	15	0	0	2	15	7
Lowther D.T.4	37	16	0	4	8	0	12	16	0	2	7	0
Chapman SCB.6	47	13	4	5	16	7	15	13	4	3	1	0
Lowther L.E.S.	23	0	0	2	16	3	8	0	0	1	8	10
Leak	34	19	0	4	5	5	12	0	0	2	5	0
Rogers Jnr.	25	6	1	3	2	0	8	16	1	1	11	8
Chapman S.5	21	6	8	2	12	5	7	2	8	1	7	0
Chapman S.6	30	0	0	3	13	4	10	0	0	2	18	4

THE CLASSIC RECORDING STUDIO
—now in operation

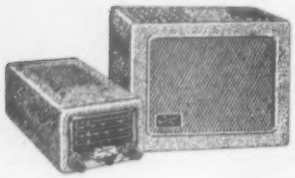
Equipped with the latest tape and disk recording equipment, and staffed by skilled and enthusiastic Recording Engineers, the Classic Recording Studio is now able to offer a really first-class recording service for the amateur and professional artiste. Full details on application.

CLASSIC ELECTRICAL CO LTD

352-364 LOWER ADDISCOMBE ROAD · CROYDON · SURREY TEL · ADDISCOMBE 6061-2

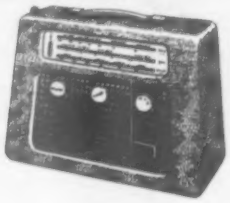
Top Sellers!

ALL-WAVE CAR RADIO
MODEL D.3



● Complete coverage on all international short wavebands from 16 metres ● Daylight and powerful overseas reception. ● Higher sensitivity—6 latest type, high performance Mullard valves. ● Slow motion control for easier short-wave tuning. ● Self-contained large loud-speaker with power-pack. ● Attractively housed. ● Greater volume through push-pull output. ● Tropicalised, shockproof.

ALL-WAVE 7v. PORTABLE
MODEL D.4—'COMPANION'



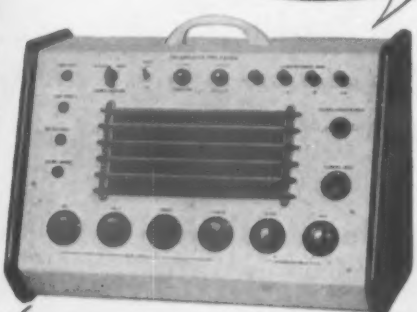
Battery Model only or as a combined Battery/A.C. Mains. ● Continuous wavelength coverage from 13 m. on 3 bands. ● 7 Mullard Valves giving powerful overseas and local reception. ● Telescopic Aerial extending to 60 inches, gives outstanding performance. ● Extra Volume—double output with better tone for improved out-door listening. ● Longer Battery Life assured by latest type of low consumption valves. ● Magic Eye—cathode-ray visual tuning. ● Rejuvenator trebles usual battery life and operates set on A.C. Mains. ● Ideal for use with heavy duty external battery.

Supersonic
REG TRADE MARK

SOLE DISTRIBUTORS WANTED IN ALL PARTS OF THE WORLD

Enquiries to: Overseas Division, CHASSAY BROS. (Pvt.) Ltd., Ingutsheni Road, BULAWAYO, Southern Rhodesia, OR in the U.K. to: OCHBERG ROBINSON (PTY.) LTD., 151 Gt. Portland St., London, W.1.

INSIST ON HIFI *plus* for Precision Instruments



Hifi
REG'D TRADE MARK

PA 25W GIVING 25 WATTS OUTPUT
PA 75W GIVING 75 WATTS OUTPUT
+ 2 Microphone Faders
+ 2 Gramophone Faders
+ Bass and Treble Controls
+ High output and low distortion factor
+ Standard Low and High Output Impedances

Look for the Registered Trade Mark.

Hifi Ltd. DERRY ST., BRIERLEY HILL, STAFFS. Telephone: Brierley Hill 7604

MANUFACTURERS OF

AUTOMATIC, AND ALSO HAND COIL WINDING MACHINES

YOUR ENQUIRIES ARE INVITED

ETA TOOL CO
(LEICESTER) LTD
29A WELFORD ROAD, LEICESTER
Phone 5386

Telecast of World Cup Football Matches

THE MOST DIFFICULT 'HOPS' OVER THE ALPS RELY ON

E M I

MICROWAVE LINKS

E.M.I. for Radar Links, Television Equipment, Wide Band Measuring Equipment, High Frequency Heating Equipment, Ground, Sea and Air Radar Systems, Photo Multipliers, Waveform Monitors and special Klystron Valves.

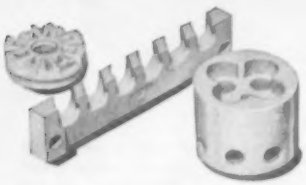
Full details from:

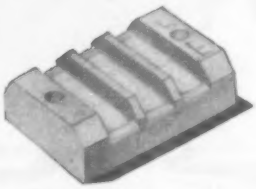
ELECTRIC & MUSICAL INDUSTRIES LTD.
HAYES · MIDDLESEX

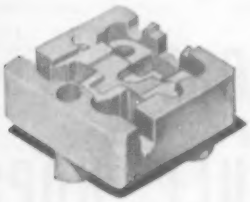
E.F.28

Bullers
CERAMICS FOR INDUSTRY

High quality material and dimensional precision are attributes of Bullers die-pressed products. Prompt delivery at competitive prices.







We specialise in the manufacture of

PORCELAIN for general insulation
REFRACTORIES for high temperature insulation
FREQUELEX for high-frequency insulation
PERMALEX & TEMPLEX for capacitors

BULLERS LIMITED

Porcelain Works: MILTON, STOKE-ON-TRENT Stoke-on-Trent 5164
Sales Office: 4, LAURENCE POUNTNEY HILL, LONDON, E.C.4 MANsion House 9971
Iron Works: TIPTON, STAFFORDSHIRE Tipton 1691

BL108

BK

cordially invite you to visit our Regent Street showroom to hear

the **NEW CR.500**
(complete with multi-stage high gain control unit)
£30.10.0

and the **NEW CR.500/UL**
ultra linear version with an even wider range control unit
£36.10.0
★ *H.P. TERMS AVAILABLE*

Also demonstrated
are the latest versions of quality equipment by ACOUSTICAL, GOODSELL, LEAK and ROGERS as well as the NEW HIGH FIDELITY AMPLIFIER by ARMSTRONG.

THESE EQUIPMENTS CAN BE HEARD WITH A WIDE RANGE OF HIGH QUALITY LOUDSPEAKER SYSTEMS AND ASSOCIATED EQUIPMENT

This and other high fidelity equipment is demonstrated at our showrooms Daily 10.30 a.m.—5.30 p.m. Saturdays 10.30 a.m.—12.30 p.m.

B. K. PARTNERS LTD.
229 Regent St., London, W.1 (Entrance Hanover St.) 'Phone REG 1051 & 7363

A new edition of a valuable textbook

Handbook of Industrial Electroplating

By E. A. Ollard, A.R.C.S., F.R.I.C., F.I.M., and E. B. Smith. 2nd Edition. Facts, figures and formulae for all who design, erect, maintain or operate electrodeposition plant and for laboratory workers who deal with plating solutions. The second edition has been considerably enlarged and includes new sections on water and drainage, purification of solutions, storage and handling of chemicals and plating-shop costing.
8¼" × 5¼". 365 pages. 122 illustrations. 72 tables.

Now ready **30s. net.** *By Post* 31s. 2d.

Obtainable from booksellers or from
Dorset House, Stamford Street, London, S.E.1

STRICTLY EXPORT ONLY

HALTRON

Leading Exporters of all types of Radio Receiving and Transmitting Tubes. Current Production and Ex-Government Surplus Special Purpose Tubes. Over 900 types in large quantities, available Ex-stock, Contractors to British Commonwealth and Foreign Governments for Army, Navy and Air-Forces, Post Offices, Civil Air Lines, etc. Ask for Export List.

SOME OF THE TYPES CARRIED IN STOCK

1AC8	3C23	6B5	6E7GT	7H7	16A5	77	806	4020A	CMG28	DK32	EL91
1A3	3C24	6B6G	6F7G	7N7	17Z3	78	809	4021A	CMV6	DL63	EY51
1A5GT	3C45	6B7	6Q7G	7Q7	18	80	810	4033A	CMV35	DL66	EZ40
1A7G	3CP1	6B8	6Q7GT	7S7	19AQ5	80/S	811	4046A	CV8	DL92	FG17
1A7GT	3D6/1299	6B8G	6R7	7S7	19BE	81	813	4046A	CV6	DL93	FG67A
1B26	3DP1	6B8GT	6R7G	7W7	19X3	82	814	4060A	CV24	DL95	FG67
1B27	3FP7	6BA6	6R7GT	7Y4	19Y3	83	815	4203E	CV42	DL94	FX215
1C5G	3LF4	6BE6	6S7	7Z4	21A6	83V	816	4212E	CV52	DRM1B	G66G
1C5GT	3Q4	6BG6G	6SA7	8D2	23D	84	826	4250A	CV57	DRM2B	GDT4B
1D5	3Q5G	6BH6	6SA7GT	8D3	24G	85J	866	4313C	CV58	DRM3B	GEX66
1D6	3Q5GT	6BJ6	6SC5	9D6	25A6/G	89 (Y)	829A	4328D	CV64	E4445	GEX34
1D8/GT	3S4	6BR7	6SC7GT	9D6	25A6GT	100TH	829B	4378	CV67	E1148	GEX35
1E7G	3V4	6BS7	6SD7GT	9 [illegible]	25L6	117L7GT	830B	4890	CV72	E1155	GEX44/1
1E7GT	4C27	6BW6	6SF5	1L	25L6GT	117N7GT	832	5763	CV75	E1190	GEX48/1
1F5G	4C29	6BW7	6SF7	10Y	25N7GT	117Z6GT	833A	7193	CV82	E1191	GEX54
1G4GT	4D1	6BX6	6SG7	10D1	25Y5	210HL	837 5513A	7475	CV85	E1192	GEX54/3
1G5G	4J53	6C4	6SH7	11D3	25Z4G	210SPG	836	8011	CV88	E1231	GEX54/4
1G6/GT	4THA	6C5	6SH7GT	11D5	25Z5	210SPT	837	8012A	CV92	E1249	GEX54/5
1H5G	4TPB	6C6G	6SJ7	12A6	25Z6G	210VPT	838	8013A	CV100	E1254	GEX56/1
1H5GT	5AP1	6C6GT	6SJ7GT	12A6GT	25Z6GT	211E	841	8016	CV101/2	E1255	GEX64
1H6G	5A/102D	6C6	6SJ7Y	12A6GT	27	215P	843	8018	CV118	E1260	GEX66
1L4	5B40	6C21	6SK7	12AH7GT	28D7	215SG	850	8020	CV119	E1271	GEX69
1LA6	5B/502A	6CD6G	6SK7GT	12AH8	30	217C	860	9001	CV125	E1275	GL446A
1LC6	5BP1	6CH6	6SL7GT	12AT6	32	220B	861	9002	CV172	E1320	GL461
1LD5	5CP1	6D6	6SN7GT	12AT7	35	220P	865	9003	CV174	E1323	GT1C
1LH4	5CP7	6D7	6SQ7	12AU6	35A/100A	220PBC	864	9004	CV179	E1359	GU20
1LN5	5C/450A	6E5	6SQ7GT	12AU7	35A5	220TH	865	9006	CV192	E1368	GU21
1N5G	5D21	6E8	6S87	12AX7	35L6GT	221D	866A	AC6/PEN	CV415	E1379	GU50
1N5GT	5FP7	6F5	6ST7	12BA6	35T	240TH	866JB	ACP4	CV987	E1426	H30
1P5GT	5GP1	6F5G	6T7G	12BE6	35TG	242A/B	869B	ACT4	CV990	E1466	H63
1Q6GT	5JP4	6F5GT	6U5G	12BH7	35W4	272A	872A	ACT17	CV998	E1474	HD14
1R4	5L35	6F8	6U5/6G5	12C8	35Z3	286A	874	AFP4B	CV1461	E1481	HF30
1R5	5LP1	6F8G	6U7G	12C8GT	35Z4GT	304TH, TL	875A	APP4C	CV1583	E1494	HL8
1S4	5L4GT	6F8GT	6V6	12DF7	35Z5GT	307A	876	APP4G	CV1588	E1496	HL8E
1S5	5T4	6F7	6V6G	12H6	36	310A	878A	AR12	CV1596	EA50	HL4
1T4	5U4G	6F7E	6V6GT	12J5GT	37	310B	884	AR13	CV6006	EB34	HL23
1U5	5V4G	6F8G	6W6	12J7GT	38	311A	909A	AR360A	CY31	EB91	HL41
1V	5X4G	6F8GT	6W7G	12K7GT	39/44	313C	923	AR4101	CY32	EBC3	HP210
2A3	5Y3G	6G5G	6X4	12K8	40	323A	931A	ARP3	D1	EBC33	HR210
2A4G	5Y3GT	6G6G	6X5	12K8GT	41	327A	954	ARP4	D15	EBC41	KMV6
2A5	5Y4G	6H6	6X5G	12Q7GT	41MP	328A/4822A	955	ARP12	D41	EC54	KR3
2A6	5Z3	6H6G	6X5GT	12SA7	41MPT	327A	956	ARP35	D42	ECC31	KR5/3
2A7	5Z4	6H6GT	6Y6G	12SA7GT	41MTL	344V	957	AR86	D43	ECC32	KR8/3
2B7	5Z4G	6J5	6Y7G	12SC7	41MXP	367A	958A	AT4	D63	ECC35	KT2
2C26	5Z4GT	6J5G	6Z5	12SG7	41STH	368A	960	AT15	D77	ECC91	KT3
2C26A	6A3	6J5GT	7A8	12SH7	42	380A	961	AT40	DA30	ECH32	KT24
2C34	6A6	6J6	7A4	12SJ7	42SPT	388A	1299A	ATP4	DA60	ECH35	KT33
2C40	6A7	6J7	7A5	12SJ7GT	43	394A	1616	AT970	DA90	ECH42	KT31
2C43	6A8G	6J7G	7A8	12SA7	45	450TL	1619	AU6	DA100	ECL80	KT32
2D21	6A8GT	6J7GT	7A7	12SK7GT	46SPEC	703A	1623	AU7	DAF91	EF22	KT33C
2E22	6AB7	6J8G	7B6	12SL7GT	46	705A	1624	AZ1	DDR35	EF36	KT44
2J21A	6AB8	6K6G	7B7	12SN7GT	50C5	707A/B	1625	AZ31	DET5	EF37	KT61
2J34	6AC7	6K6GT	7B7E	12SQ7	50CD6G	708A	1626	AZ41	DET9	EF37A	KT66
2J36	6AF6G	6K7	7BP7	12SQ7GT	50L6GT	709A	1629	B31	DET12	EF39	KT71
2J39	6AG5	6K7G	7C6	12SR7	50Y6GT	713A	1635	B250	DET16	EF41	KTW61
2J45	6AG7	6K7GT	7C5	12U5G	52A	714AY	1642	BL63	DET19	EF50	KTW62
2J54	6AJ7	6K8	7C6	12X3	53KU	717A	1646	BT45	DET24	EF54	KTW63
2J54B	6AK5	6K8G	7C7	12Y4	54	722A/B	1815	C3B	DF80	EF80	KTZ41
2X2/879	6AK6	6K8GT	7D5	14B6	57	724A	1851	C1C	DF91	EF91	KTZ63
2X2A	6AL5	6L6G	7D7	14E7	58	725A	1852	C9A	DF92	EF92	KTZ73
3A4	6AM5	6L6	7D8	14H7	59	726A	2050	CAG25	DH63	EF93	L6
3AP1	6AM6	6L6G	7D9	14K7	61P	800	2051	CAV25	DH76	EF94	L63
3B7/1291	6AQ5	6L6GA	7E5	14R7	71A	801	2151	CK1005	DH77	EF96	L65
3B24	6AT6	6L7	7E8	14S7	72	801A	2051	CL33	DH81	EL32	L77
3B26	6AU6	6L7G	7E7	15D2	73	803	4003A	CMG3	DH101	EL33	L810
3B/151A	6AV6	6N7	7F7	15E	75	805	4019A	CMG22	DH107	EL35	LD810
3BP1	6B4G	6N7G	7G7	15R	76	807	4019B	CMG25	DK91	EL41	LD410

HALL ELECTRIC LTD

HALTRON

HALTRON HOUSE, 49-55 LISSON GROVE,
LONDON N.W.1.

HALTRON

Tel.: Ambassador 1041 (5 lines) Cables: Hallectric, London

THE NEW Armstrong A·10 HIGH FIDELITY AMPLIFIER

Specialists in High Quality Reproduction for over 20 years

ULTRA-LINEAR

CONTROL UNIT

AMPLIFIER

Output: 10-12 watts. Distortion: Less than .1% total harmonic at 8 watts. Frequency response: 10-100,000cps., within 1 db 15-30,000cps. Hum level: Better than 80 db down. Damping factor: 40. Feed-back: 3 loops, main overall loop being 28 db obtained by means of a tertiary winding on the output transformer. Input required: 250 millivolts for 10 watts output. Valves used: Mullard low noise pentode EF86, ECC82, double triode, 2 EL37, triode-tetrode connected, GZ32 indirectly heated rectifier. Components: All fully tropicalised. Mains transformer by WODEN, PARTRIDGE output transformer, TCC condensers, Morganite controls and resistors. Mains input: Model A10, 200-250 v. A.C. 50 cycles, Model A10E, 100-110 v. A.C. 40-60 cycles. Finished: Hammered bronze.

Controls: 1. Input (a) Radio 50-150 Millivolts. (b) Gram. (low impedance) 15-100 m.v (c) Gram. (high impedance) 70-150 m.v. (d) Microphone or Tape Recorder 10-100 m.v. 2. Equaliser (a) 78° (b) 78°. (c) L.P. (d) American NARTB 3. Filter (a) Roll-off 5 kcs. (grad). (b) 7 kcs. (c) 9 kcs. (d) 9 kcs. (steep). (e) Level response. 4. Treble lift or cut of 15 db. 5. Bass lift or cut of 15 db. 6. Volume control combined with on/off switch. Valve: Mullard ECC83 double triode. Power supply for radio unit 300 v. 20 ma., 6.3 v. 1.5 a. Finished: Hammered bronze with engraved Florentine bronze panel.

SEE PAGE 131 FOR OUR RADIO AND T.V. MODELS. WRITE TO US FOR DESCRIPTIVE LITERATURE.

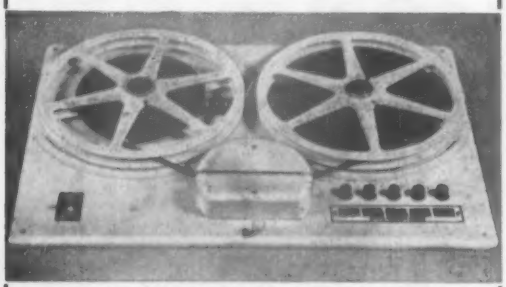
★ **DEMONSTRATIONS** at your local High Fidelity specialists or at our showrooms in Holloway 9 a.m. to 6 p.m. weekdays (Sats. until 5 p.m.) also Special High Fidelity Demonstrations on Thursday evenings 8 p.m.

When comparing prices of High Fidelity Equipment ★ THE A.10 INCORPORATES ALL NECESSARY FILTERS, and no additional filter units are required. ★

PRICE: AMPLIFIER **£19·15·0** CONTROL UNIT **£9·15·0**

ARMSTRONG *WIRELESS & TELEVISION CO., LTD., WARLTERS ROAD, HOLLOWAY, LONDON N.7. Tel.: NOR 3213/4*

MOTEK



TWO SPEED—SIMPLE PUSH BUTTON CONTROL

THE NEW K6 UNIT

List Price 19 GNS.

SEE AND HEAR IT AT YOUR LOCAL DEALER

MODERN TECHNIQUES

138-144 Petherton Road, London, N.5

Tel.: Canonbury 5896

M. R. SUPPLIES Ltd.

(Established 1935)

Immediate despatch of the following first-class material, mostly brand new, fully and fairly described. Prices nett.

ELECTROMAGNETIC COUNTERS, operating from 24 v. D.C. (or 30 v. A.C.). Each unit contains two separately energised counters, each counting up to 9999 and one or both can be used at the same time. Manual re-set. Speed exceeds 1,000 counts per minute, if required. In cylindrical housing 5in. high with 3in. dia. window. For panel mount 3¼in. hole required. These are brand new in moisture proof pack, **37/6** (des. 2/-).

TOROIDAL WIRE-WOUND RESISTANCES, 50 ohms 1 amp., **7/6** (des. 1/-).

REDUCTION GEAR BOXES, ratio 3/1. Can be used for step-up. Transmission up to ¼ h.p. Housing 7¼in. × 6in., bronze gearing, very robust, **40/6** (des. 2/6). Also larger model, same ratio trans. up to 1 h.p., **50/6** (des. 5/-).

PHILIPS VARIABLE TRANSFORMERS. Immediate delivery—great price saving, prices from **£7/5/-** (280 va) to **£19/17/6** (2080 va). Details on request.

MICROAMMETERS. Very fine offer, limited to about 400 metres only. Deflection 0/50 microamps, first-grade m/coil, in projection housing, 2¼in. dia. by 3in. proj. Exceptionally suitable for lab. bench work. Brand new, **55/6** (des. 1/6). Also a few new 2¼in. flush panel 0/50 microammeters, 1of gr. m/coil, same price.

SELENIUM RECTIFIERS (S.T.C.). Exceptional offer of brand new high duty ratings, in very limited supply. Single units: 15 volts 75 amps, 30 volts, 30 amps, 60 volts 15 amps, any one **£7/17/6** (des. 5/-). Also two units, 120 volts 12 amps, the pair, **£11/17/6** (des. 7/6). Also four units, 240 volts 15 amps, the four **£22/10/-** (des. 10/-). Other useful ratings from stock: 24/30 volts 4 amps, **25/-**; 12/15 volts 8 amps, **29/6** (des. either 2/-). We can supply many other rectifier requirements—all new goods.

ROTARY CONVERTERS. Input 12 volts D.C. output 230 volts A.C. 50 cycles, 100 watts. Brand new machines in special moisture-proof pack—the perfect unit for locations where standard mains voltage is required from low tension input. A few only at **£4/10/-** each (des. 5/-).

CAPACITOR INDUCTION MOTORS. 220/240 v. 50 c. 1 ph. Highly efficient motors with motor shaft (1440 r.p.m.) and geared right-angle shaft (300 r.p.m.). Continuously rated for use at either speed (or both). With correct capacitor, **£4/10/-** (des. 2/6). These are all tested and perfect.

P.I.P. GEARED MOTORS. We are probably the largest stockists in London. Series wound universal 220/240 v. A.C./D.C., reversible. Average overall length, 8in. Final speed 100 or 50 r.p.m., either **£5/17/6** (des. 2/6). Final speed 10 or 1 r.p.m., either **£6/18/6** (des. 2/6). Also cap/ind. type, 220/250 v. 50 c. 1 ph., reversible, choice of final speeds: 17, 33, 46 or 92 r.p.m., any one with correct capacitor, **£8/17/6** (des. 2/6). Also double reduction cap./ind. units, very high torque, 0.2 to 10 r.p.m., **£11/10/-** (des. 5/6). **SMALL GEAR BOXES**, double worm gear, 300/1 reduction, in die-cast housing, 2¾in. × 2¼in. × 2in. Final shaft ¼in. dia. by 1¼in. proj. Ball bearing, transmission up to 1/60th H.P., **42/6** (des. 1/6).

SHADED POLE INDUCTION MOTORS, 200/250 v. A.C., torque 400 grm./cms. Size 3in. dia. by 3in. long, shaft proj. 1in. Silent running and ideal for recorders, gramomotors, fans, mirrors, etc., **27/6** (des. 1/-).

LONDEX MINIATURE MAINS RELAYS, 230 v. A.C. coil, 2-pole "make," 5 amps. size: 2¼in. × 1¼in. × 1in. Silent in operation, **19/6** (des. 9d.).

INSTRUMENT RECTIFIERS. We have a limited supply, brand new, ex-well-known makers. 5 mA copper oxide, **5/6**.

We guarantee full satisfaction with every item purchased from us.

M. R. SUPPLIES, LTD., 68 New Oxford St., London, W.C.1.

Telephone: MUSeum 2958

The LIGHTEST and smallest re-chargeable accumulator

Full details of this amazing accumulator will be sent FREE. Ask for Brochure A/WW.

VENNER ACCUMULATORS LTD. KINGSTON BY-PASS · NEW MALDEN · SURREY · Tel. MALden 2442

Associated Companies . VENNER LIMITED VENNER ELECTRONICS LIMITED

SHORTAGE OF RADIO and T/V ENGINEERS

There is an assured well-paid future for those trained and willing to train in electronics, radar and radio. Modern industrial techniques demand more and more highly trained personnel and the gap between demand and supply is still widening.

This is your opportunity — write for our free brochures giving full details of courses to:

E.M.I. INSTITUTES

DEPT. 127U, 10 PEMBRIDGE SQUARE, LONDON, W.2.
Telephone: Bayswater 5131/2.

The College associated with a world-wide electronics industry.

IA18

1 YEAR COURSE

We offer full-time day course for one year in the Principles and Practice of Radio and Television. ***Next course commences on 30th August, 1954.***

3 YEAR COURSE

in Telecommunication Engineering (including opportunity for six months' practical attachment). ***Next course commences on 30th August, 1954.***

Associated with
'H.M.V.'
MARCONIPHONE
COLUMBIA
etc.

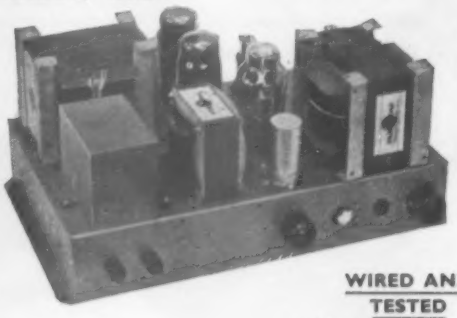
Other Components by :
T.C.C., BELLING-LEE, WELWYN, OSRAM, COSSOR, ERIE.

Come and Hear it!

THE WORLD-FAMOUS WILLIAMSON AMPLIFIER

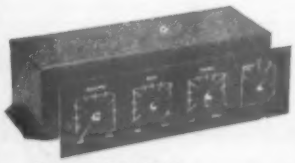
WITH PARTRIDGE TRANSFORMERS & CHOKES

By common consent the finest ever!



WIRED AND TESTED
CASH PRICE £26.15.6
or
DEPOSIT £8.18.6
11 PAYMENTS £1.15.8

KIT FORM
CASH PRICE £22.1.9
or
DEPOSIT £7.7.0
11 PAYMENTS £1.9.5



P.A.I. PRE-AMP
CASH PRICE £8.18.6
or
DEPOSIT £2.19.6
11 PAYMENTS 11.10

ASSOCIATED EQUIPMENT

Connoisseur 3-speed Motor	£23	8	11
Collaro 3-speed Transcription Motor	£13	9	6
Collaro AC3/534 with Studio "O" or "P" Pick-up...	£10	6	0
Garrard "T" 3-speed Motor with fixed Crystal T.O.H.	£10	12	8
Garrard "T.A." 3-speed Motor choice of MPM2 Heads	£10	16	0
Garrard L.R.S.I. Centre Spindles for 45 records	£1	3	3
Connoisseur Pick-up with 2 heads	£9	5	6
Decca Pick-up with 2 XMS Heads	£6	9	5
Acos GP20/Hi-G with 2 heads	£5	10	7
Speakers :			
Goodmans Axiom 150	£10	5	6
Goodmans Axiom 22. Mk II	£14	14	0
W.B.S810 8in. Unit 3 ohm	£3	0	6
W.B.HF912 9in. Unit 3 ohm	£3	7	0
W.B.HF1012 10in. Unit 3·15 ohm	£3	13	6
Wharfedale Super 5CS/AL	£6	13	3
Wharfedale Super 8CS/AL	£6	13	3
Wharfedale Golden 10in.	£7	13	3
Wharfedale Golden/CSB	£8	6	7
Wharfedale W12/CS	£9	15	0
Wharfedale Super 12/CS/AL	£17	10	0
Wharfedale Separators Type "B" 1000 c/s. 7-16 ohm	£3	2	6
Wharfedale Separators Type "D" 1000 c/s. 2-6 ohm	£4	2	6
Wharfedale Separators Type "F" 3000 c/s. 7-16 ohm	£2	8	6
Wharfedale MGI Equaliser	£2	17	6
Wharfedale 3-way ½ section Crossover	£8	10	0

TELE-RADIO (1943) LTD.

189 EDGWARE ROAD, LONDON, W.2. Phone: PAD 4455/6

SHOP HOURS: MON.-SAT. 9 a.m. to 6 p.m. THURSDAY 9 a.m. to 1 p.m.

METERS

LARGE AND VARIED STOCKS AVAILABLE FOR IMMEDIATE DELIVERY

EXAMPLES FROM OUR RANGE OF 2½" FLUSH PATTERN MOVING COIL INSTRUMENTS (as illustrated)

AMPERES D.C. 0-1, 2, 3, 5, 10, 15, 20, 25, 30, 50.
MILLIAMPS. 0-1, 1-0-1, 0-5, 10, 15, 20, 25, 30, 50, 100, 250, 500.
MICROAMPS. 0-50, 100, 200, 250, 400, 500, 750, 50-0-50, 100-0-100, 250-0-250, 500-0-500.
MILLIVOLTS. 0-10, 25, 50, 75, 100, 500.
VOLTS D.C. 0-1, 5, 10, 15, 25, 50, 100, 250, 500, 750, 1,000.
VOLTS A.C. 0-5, 10, 15, 25, 50, 100, 250, 500, 750, 1,000.

We can supply meters with NON-STANDARD, CURRENT and VOLTAGE RANGES to any specification. DELIVERY 7-14 days.
MOVING IRON, THERMO & ELECTROSTATIC INSTRUMENTS ALSO AVAILABLE.

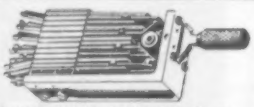
ANDERS ELECTRONICS LTD.

91, HAMPSTEAD ROAD, LONDON, N.W.1.
Telephone: EUSton 1639

Suppliers to Government Departments, B.B.C., Leading Manufacturers & Research Laboratories

RELAYS

PROMPT DELIVERY



UNISELECTORS, PLUGS—SOCKETS, HAND GENERATORS etc.,

THE

KEYSWITCH CO.

P.O. TYPE RELAYS TO YOUR SPECIFICATION

ALL POST OFFICE EQUIPMENT

SEND ALL YOUR ENQUIRIES TO

191 KENSAL ROAD, LONDON, W.10
LAD. 0466

L.G. WILLIAMS LTD

for SHEET METAL CABINETS · INSTRUMENT CASES · RACKS · PANELS · METAL DECKS FOR TAPE RECORDERS · CONTROL DESKS TRANSFORMER CASES · CHASSIS, Etc., Etc., to your specification.

Single or Quantity Enquiries Invited.

As supplied to Magnetic Time Co.

BRIDGE WORKS, THE CRESCENT, WIMBLEDON, S.W.19
Phone: WIMbledon 2400

Reflectograph

MAGNETIC TAPE RECORDERS

Introduced at the BIF Olympia

Reflectograph present two new low frequency magnetic tape recorders for strain gauge, vibration and fatigue measurement, or for long-term electrical phenomena recording. Both these instruments use a coded pulse form of modulation and are available with a second recording/playback channel for reference purposes.

Brief Technical Specifications

Model PLF1 — Sensibly flat from zero to 150 cycles but — 3DB at 150 cycles. Tape speed 3.75" per second. Manual setting of DC level. DC coupled input preamplifier. Input sensitivity 1 volt.

Model PLF2 — DC, sensibly flat from zero to 250 cycles, but — 3DB at 250 cycles. Automatic setting of the DC level. Balanced DC coupled input preamplifier. Input sensitivity 10 mV, 100 mV and 1 volt.

For more detailed information please write to the manufacturers

RUDMAN DARLINGTON (ELECTRONICS) LTD

Wednesfield, Staffs. *Tel: Wolverhampton 31704*

WhiteAd B2728R

an inexpensive test set with 21 basic ranges

The Pullin Series 100 Multi-Range Test Set is an inexpensive piece of equipment invaluable to radio and electronic engineers. It is a compact, portable instrument with a total of 21 basic self contained ranges which provide adequate facilities for the measurement of A.C. voltage, D.C. voltage and current, and resistance. All voltage measurements are at 10,000 Ohms per volt.

MIP LTD

RETAIL PRICE £11·11·0 COMPLETE

instrumentation by

PULLIN

LABORATORY INSTRUMENTS DYNAMOMETER TESTING SETS
INDUSTRIAL SWITCHBOARD INSTRUMENTS
PORTABLE TESTING SETS

SERIES 100 MULTI-RANGE TEST SETS

MEASURING INSTRUMENTS (PULLIN) LTD., ELECTRIN WORKS, WINCHESTER STREET, ACTON, LONDON, W.3 • PHONE: ACORN 4651-4995

Telmag

'C' TYPE & TOROIDAL WOUND CORES

Made from grain oriented steels

The use of grain oriented steels in transformer and choke design permits a considerable reduction in weight and size as well as giving higher efficiency. Telmag specialise in the production of a wide variety of grain oriented steel cores designed with these objectives in view. Toroidal, or 'C' Type cores can be supplied to any desired proportions, as listed in R.C.S.C. Specification RCL. 193, or to special order. Further Telmag developments feature a range of 'E' type cores for 3-phase working, and your enquiries for these types are welcomed. Please write for technical literature, available upon request.

TELMAG ADVISORY SERVICE

We maintain a specialised advisory service and are always pleased to co-operate on any specific problem.

TELCON-MAGNETIC CORES LIMITED

CHAPELHALL INDUSTRIAL ESTATE, CHAPELHALL, LANARKSHIRE. Tel.: AIRDRIE 2283

FREQUENCY METERS

2½-8" up to 10,000 cycles

ACTIVE CURRENT METERS

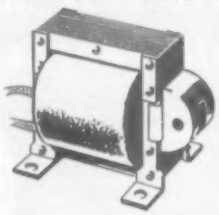
(I × cos Ø)

A full range of switchboard and portable instruments, including four types of Millirange Meters.

THE ELECTRICAL INSTRUMENT CO. (HILLINGTON), LTD.

Boswell Square Industrial Estate, Hillington, Glasgow, S.W.2. Halfway 1166 and 2194

A. C. SOLENOID TYPE SB.



Continuous 2.3/8 lb. at 1"
Instantaneous to 16 lb.

100% PRODUCTION INSPECTION

Smaller Sizes Available.
Also Transformers to 6 KVA 3 Phase

R. A. WEBBER LTD.

18 FOREST ROAD, KINGSWOOD, BRISTOL. PHONE 74065

LEEVERS RICH

For clean, noise-free Recordings—the

LeeRaser

Tape De-magnetiser—as supplied to B.B.C. and leading recording studios.

FOR A.C. MAINS

MODEL B (up to 7" spool capacity) £9. 10. 0.
MODEL C (up to 12" spool capacity) £15. 0. 0.
} Tropical Specification

LEEVERS-RICH EQUIPMENT LTD.

Manufacturers of high quality magnetic recorders

37, WARDOUR STREET, LONDON, W.1. GER. 4502

PREMIER RADIO CO.

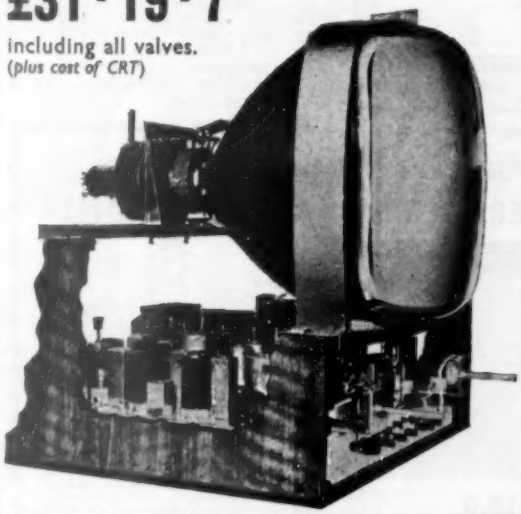
B. H. MORRIS & CO. (RADIO) LTD. EST. 40 YRS.

(Dept. W.W.) 207 EDGWARE RD., LONDON, W.2. Tel.: AMBassador 4033 & PADdington 3271

MAY BE BUILT FOR

£31·19·7

including all valves.
(plus cost of CRT)



The NEW
PREMIER TELEVISOR

Brief Technical Details are as follows:
20 valves (plus tube) Superhet Receiver, tunable from 40-68 Mc/s without coil or core changing. Wide Angle scanning Flyback EHT giving 14 kV. Duomag Focaliser, permanent magnet focussing with simple picture centring adjustments, suitable for any 17in. or 14in. wide angle Tube, may also be used with a 12in. Tube with very minor modifications.

VISION CIRCUIT Common RF Amplifier single valve frequency changer, two IF stages, Video Detector and Noise Limiter followed by special type of Video Output Valve. ALL COILS PRE-TUNED ASSURING ACCURATE ALIGNMENT AND EXCELLENT BAND-WIDTH.

SOUND CIRCUIT Coupling from anode of frequency changer, two IF stages, Double Diode Triode detector and first LF Amplifier, Diode Noise Limiter and Beam type Output Valve, feeding a 10in. Speaker. ALL COILS PRE-TUNED

TIME BASES 2 valve sync. Separator, giving very firm lock and excellent interlace.

LINE TIME BASE Blocking Oscillator using a pentode driving a high efficiency output stage comprising Ferroxcube Cored Output Transformer with Booster Diode.

FRAME TIME BASE Blocking Oscillator driving a Beam Output Valve coupled through a Transformer to the high efficiency FERROX-CUBE Cored Scanning Coils.

POWER PACK Double wound Mains Transformer supplying all L.T. and H.T. using two full-wave Rectifiers.

THE COMPLETE TELEVISOR IS SAFE TO HANDLE, BEING COMPLETELY ISOLATED FROM THE MAINS BY A DOUBLE WOUND MAINS TRANSFORMER. ALL PRESET CONTROLS CAN BE ADJUSTED FROM THE FRONT, MAKING SETTING UP VERY SIMPLE.

The Televisor may be constructed in 5 easy stages: **(1) Vision, (2) Time Base, (3) Sound, (4) Power Pack, (5) Final Assembly.** Each stage is fully covered in the Instruction Book, which includes layout, circuit diagrams and point-to-point wiring instructions. The Instruction Book also includes full details for converting existing Premier Magnetic Televisors for use with modern wide angle tubes. All components are individually priced.

Console Cabinets in figured walnut can be supplied for the above receiver at a cost of £13/10/-, plus 21/- packing and carriage, as previously advertised.

Instruction book 3/6 Post Free.

The PREMIER De Luxe PORTABLE MAGNETIC TAPE RECORDER KIT

Including ALL parts, Valves, Portable Cabinet, 8in. Loudspeaker, Tape-Table, Reel of 'Scotch Boy' Tape and Rewind Spool, and Microphone. **PRICE £37.4.0** *(Plus 15/- Pkg. Carr. & Ins.)*

THE 7-VALVE AMPLIFIER IS SPECIALLY DESIGNED FOR HIGH QUALITY REPRODUCTION

Brief specification: **VALVE LINE-UP:** EF37A First Stage, 6SL7 second Stage and Tone Control; 6V6 Output 6X5 Rectifier; VT501 Bias and Erase Oscillator; 7193 Record Level Amplifier; 6U5 Magic Eye Record Level Indicator. **OUTPUT:** 4 Watts. **FREQUENCY RANGE:** 50 c.p.s. to 9,000 c.p.s. **CONTROLS:** Volume; Record/Playback Switch; Treble Boost; Bass Boost—on/off.

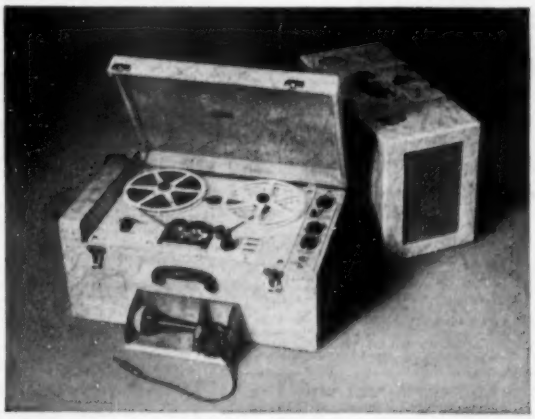
MICROPHONE : Crystal—specially designed for Premier by famous manufacturer

SEPARATE UNITS CAN BE SUPPLIED AS LISTED BELOW

AMPLIFIER KIT (including 8in. Speaker)	£11 0 0	plus 5/- pkg./carr.
AMPLIFIER (already built, wired and tested)	£14 15 0	plus 7/6 pkg./carr.
LANE TAPE TABLE & REWIND SPOOL	£17 10 0	plus 7/6 pkg./carr.
PORTABLE CABINET (rexine covered)	£4 19 6	plus 5/- pkg./carr.
MICROPHONE	£2 19 6	plus 1/- pkg./carr.
REEL OF NEW M.G.-S-III "SCOTCH BOY" TAPE (1,800ft.)	£1 15 0	plus 1/- pkg./carr.

★ **INSTRUCTIONAL BOOKLET** **2/6**
This is credited if a complete kit of the Tape Recorder is ordered.

Supplied completely assembled 39 GNS.
Plus 1 gn. Pkg. & Carr.



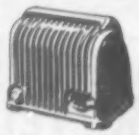
TERMS OF BUSINESS: *Cash with order or C.O.D. over £1. Please add 1/- for Post Orders under 10/-, 1/6 under 40/-, unless otherwise stated.*

PREMIER RADIO COMPANY

ONLY A FEW LEFT!

THE FAMOUS **'SOBELL'** 4-VALVE SUPERHET TABLE RECEIVER

M. & L. WAVEBANDS



Valve line-up: 12J7, 35L6, 14S7, 35Z4.
Entirely transportable and unusually sensitive owing to special feed-back circuit employed. Housed in attractive plastic cabinet.
Choice of 2 colours—Brown and Cream.
Carrying handle incorporated in design. For use on 200/250 A.C./D.C. mains. **£8.5.0**
Plus 5/- Pkg./carr./Ins.

Fully covered by Manufacturer's Guarantee

METERS

Large stocks available, a few of which are enumerated below:—

Full Scale Deflection	Scale Length in.	External Dimensions in.	Movement	
25A	1½	2½ round	R.F. Thermo	7/6
3.5 A	1½	2½ × 2½	R.F. Thermo	7/6
4 A	1½	2½ × 2½	R.F. Thermo	7/6
20 A	1½	2½ round	M/C	8/6
40 A	1½	2½ round	M/C	8/6
1.5 mA	1½	2½ round		12/6
5 mA	2	3½ round		7/6
6 mA	2	3½ round		16/9
50 mA	1½	2½ × 2½	M/C	7/6
20 V	2	2½ × 2½	M/C	6/6
40 V	1½	2½ × 2½	M/C	8/6

AUTO TRANSFORMERS 50 WATTS
Input Output 0-110-210-220-230-240-250 volts. Plus 1/-. P. & P. **7/6**

WHY PAY MORE?

WILLIAMSON AMPLIFIER KIT 15gns.
plus 7/6 post, pkg. & ins.
This kit is absolutely complete and all components are guaranteed exactly to author's specification.

WILLIAMSON OUTPUT TRANSFORMER
(author's spec.), 3.6 ohms sec. **£4.4.0**

MAINS TRANSFORMER 6P425A (with additional 6.3 v. 3 a. and capable of supplying an extra 50 mA. for Pre-amp. or Feeder Unit) **£2.12.6**

T.V. PRE-AMPLIFIER
Amplifier Unit Type 206A using 9-VR91 valves suitable for operation on London frequency. Brand new. Plus 1/6 pkg. and carr. **19/6**

Build these NEW PREMIER DESIGNS

ALL-DRY BATTERY PORTABLE RADIO RECEIVER

MAY BE BUILT FOR **£7.18.0** Plus 2/6 Pkg. & Carr.

4 miniature Valves in a Superhet Circuit covering medium and long waves. Rexine covered Cabinets 11½in. x 10in. x 5½in. in two contrasting colours. Wine with Grey Panel, or Blue with Grey Panel, please state choice when ordering. **THE SET MAY BE USED EVERYWHERE**—*home, office, car or holidays.* **INSTRUCTION BOOK, 1/6 (Post Free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.**

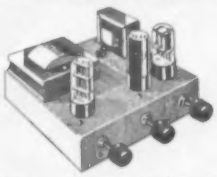
TRF RECEIVER

MAY BE BUILT FOR **£5.15.0** Plus 2/6 Pkg. & Carr.

The circuit is the latest type TRF using 3 valves and Metal Rectifiers for operation on 200/250 A.C. mains. Wave band coverage is 180/550 metres on medium wave and 800/2,000 metres on long wave. The dial is illuminated and the Valve line-up is 6K7 H.F. Pentode 6J7 Detector and 6V6—Output. The attractive Cabinets to house the Receiver size 12in. long, 6½in. high, 5½in. deep can be supplied in either WALNUT or IVORY BAKELITE or WOOD.

INSTRUCTION BOOK 1/- (Post Free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

4-WATT AMPLIFIER



MAY BE BUILT FOR **£4.10.0** Plus 2/6 Pkg. & Carr.

Valve line-up 6SL7, 6V6 and 6X5. FOR A.C. MAINS 200/250 VOLTS. The twin triode 6SL7 is used for preamplification and also for a comprehensive tone control circuit, which includes two very wide range and continuously variable tone controls for bass and treble. The output Valve is of the beam type and feeds 4 watts into a specially designed output Transformer which is suitable for either 3 ohm or 15 ohm Speakers. Negative feed-back is applied from the secondary of the output Transformer over the whole Amplifier to the input stage giving an excellent frequency response. Due to the high gain and wide range tone controls any type of pick-up may be used. Overall size 9 × 7 × 8in. Price of Amplifier complete, tested and ready for use, £5/5/-, plus 2/6 pkg. and carr.

INSTRUCTIONS BOOK 1/- (Post Free) which includes Assembly and wiring diagram, also a detailed Stock List of priced components.

FILAMENT TRANSFORMERS

Input 230 v. A.C. Output 12 v. at 1 amp. Completely shrouded. Price **9/11**

HIGH QUALITY RADIOGRAM CHASSIS

A limited quantity of these Chassis which were produced by a leading manufacturer of quality Radiograms are available.
The 3 waveband 5 valve Superhet circuit utilises the following Valves: 6K8G—Frequency Changer, 6B8G—IF Amplifier, Detector and AVC, 6SL7G—Pickup Amplifier and AF Amplifier, 6V6G—Beam Power Output Tetrode, 5Z4G—full wave Rectifier.
A special Gramophone Pre-Amplification circuit is used giving very high gain on any type of Pickup. Also included is a continuously variable Tone Control. The large horizontal tuning scale measures 11in. × 3½in. Chassis measures 14½in. × 9in. × 6in. The Chassis was designed to fit into a Radiogram costing £79.

Our special price is **£13.19.6** plus 5/- packing and carriage.

POWER SUPPLY UNIT

Incorporating output stage. Supplies an output of 250 volts at 80 mA. which is suitable for the R1155 with the output stage.
Jones plugs for connecting the Power Pack to the Receiver are included. The 6V6 output stage complete with Output Transformer and 6½in. speaker is built into the unit. Price £5/5/-, plus 5/- packing and carriage.

CORRECT ASPECT WHITE
Rubber Mask—Round or Flat

6in.	8/6	9in.	9/6
12in.	10/11	15in.	27/6

MINIATURE TUNING CONDENSERS

2-gang .0005 mfd. with trimmers 6/9

PREMIER VARIABLE IMPEDANCE "MATCHMAKER" M.O.15 OUTPUT TRANSFORMER

Designed to meet the demand for an efficient variable ratio Output Transformer. 11 ratios from 13:1 to 80:1 all centre tapped and can be used to match any output valves either single- or push-pull Class "A" "AB1" "AB2" or "B" to any low impedance speech coil or combination thereof. Primary Inductance 60 henries 15 watts audio 100 mA. Price 45/-.

LOUDSPEAKERS

ELAC—2½in. dia., Moving Coil, 15 ohm imp..... 15/-
PLESSEY—3in. dia., Moving Coil, 3 ohms imp... 9/11
ELAC—3½in. dia., Moving Coil, 3 ohms imp..... 15/-
GOODMANS—5in. dia., Moving Coil, 3 ohms imp. 15/6
ELAC—5in. dia., Moving Coil, 3 ohms imp. 19/6
PLESSEY—5in. dia., Mains Energised, 2 ohms imp. (600 ohms field) with Pentode Transformer 22/6
PLESSEY—5in. dia., Mains Energised, 3 ohms imp. (600 ohms field) 19/6
PLESSEY—10in. dia. Moving Coil, 3 ohms imp... 23/6
GOODMANS—12in. dia., Moving Coil, 15 ohms Plus 5/- packing and carriage 28/6
VITAVOX—K12/20 12in. dia., Moving Coil, 15 ohms imp. £11/11
Plus 5/- packing and carriage.

SPECIAL OFFER

A 12in. TRUVOX P.M. SPEAKER
(2-3 ohm Voice Coil) For only
These are brand new in Maker's Cartons **47/6**
Plus 2/6 Pkg. and Carr.

ACCUMULATORS

2 volt 10 amp. (by famous maker) 4/11
2 volt 16 amp. 5/11

MOVING COIL METER

A super quality Moving Coil Meter basic movement 2mA. and 4 mA. Scale dimensions 2½in. Overall dimensions 2½in. dia. 1½in. deep. Bakelite Case projecting type. At present scaled 1 amp. R.F. By removing thermo couple, reversing scale and recalibrating the meter, a high grade test instrument with any range above the basic F.S.D. may be built up. Price 2 mA. **5/9**, 4 mA. **4/9**.

MICROPHONES

LUSTRAPHONE: Moving Coil; High Impedance. Stand Type: **£5/15/6**—Hand Mike **£6/6/-**.
RONETTE—Crystal Mike: Incorp. the Filter Cell Insert; High Imped. Ball Type: **£3/19/6**.
CRYSTAL MICROPHONE—Rothermel 2AD56. Especially recommended. **£2/19/6**. **Table stands for all the above 10/6 and 17/6.**
ACOS. High impedance Crystal Microphone, type 35-1, 25/-.
ACOS. High Impedance Crystal Microphone, type 33-1, £2/10/-.
ACOS. "MIC 30" Impedance Crystal Microphone, £2/10/-. (This Microphone can be used as either Hand or Desk type)

CRYSTAL HAND MICROPHONE

High Impedance. Excellent frequency response, light weight. Gives very high quality results when used with tape recorder, amplified for any type of P.A. equipment. Complete with screen lead and plug plus 1/6 Pkg. & Carr. Price **22/6**.

CRYSTAL MICROPHONE

An entirely insulated crystal microphone which can be safely used on A.C./D.C. amplifiers. High impedance. No background noise, really natural tone. The ideal Mike for tape, wire and sound projectors. Price **29/6**.

PREMIER RADIO COMPANY

Limited supplies of C.R. TUBES

VCR517C
6½in. picture. This tube is a replacement for the VCR97 and VCR517. Guaranteed full size picture.
Price 35/- Plus 2/6 pkg., carr., ins.

VCR516
9in. blue picture. Heater volts 4 Anode 4 Kv. In manufacturers' original carton. £3/19/6. Plus 5/- pkg., carr., ins.

ALL BRAND NEW

★ **QUALITY CRYSTAL PICK-UP ROTHERMEL TYPE U48 26/-**
Plus 1/6 Pkg. and Carr.

GRAMOPHONE CABINETS—Portable
By famous manufacturers
Substantial Wooden Case, Rexine covered, including wooden motor board. Outside dimens.: Hgt. (when closed) 5½in., length 15in., depth 13½in., Clearance space, under motor board when closed 2½in.

Price 22/6, plus 2/6 pkg., carr.

Carrying handle and clip supplied free.

SPECIAL OFFER
PREMIER MAINS TRANSFORMERS
All primaries are tapped for 200-230-250 v. mains 40-100 cycles. All primaries are screened.

SP173S, 175-0-175, 50 mA., 4 v. @ 1 a., 4 v. @ 2-3 a. 15/-
SP226A, 250-0-250, 100 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a. 21/-
SP251, 350-0-350, 150 mA., 4 v. @ 1-2 a., 4 v. @ 2-3 a., 4 v. @ 2-3 a. 25/-
SP252, 350-0-350, 150 mA., 5 v. 2-3 a., 6.3 v. 2-3 a., 6.3 v. 2-3 a. 30/-
SP501, 500-0-500, 150 mA., 4 v. @ 2-3 a., 4 v. @ 2-3 a., 4 v. @ 2-3 a., 4 v. @ 2-3 a. 37/-
SP501A, 500-0-500, 150 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a., 6.3 v. @ 2-3 a. 40/-
SP425A, 425-0-425, 200 mA., 6.3 v. @ 2-3 a., 6.3 v. @ 2-3 a., 5 v. @ 2-3 a. 52/6
250-0-250, 80 mA., 6.3 v. @ 4 a., 5 v. @ 2 a. 19/6
350-0-350, 80 mA., 6.3 v. @ 4 a., 5 v. @ 2 a. 19/6
200-230-250, output 3 v.-30 v. @ 2 a. 17/6

RECTIFIERS
E.H.T. Pencil Type S.T.C.

Type K3/25	650 v.	1 mA.	4/7
,, K3/40	3.2 kV.	1 mA.	6/-
,, K3/45	3.6 kV.	1 mA.	8/2
,, K3/50	4 kV.	1 mA.	9/8
,, N3/160	12 kV.	3 mA.	21/6

H.T. Type S.T.C.

Type RM1	125 v.	60 mA.	4/-
,, RM2	125 v.	100 mA.	4/6
,, RM3	125 v.	125 mA.	5/6
,, RM4	250 v.	250 mA.	18/-

L.T. Type Full Wave

6 v. 1 amp.	4/-
12 v. 1 amp.	8/-
12 v. 2 amp.	10/9
13 v. 4 amp.	15/-

A.C.R.I. C.R. TUBES
5in. screen. 4 volt Heater. This Electrostatic Tube is recommended as eminently suitable for Television. 15/- plus 2/6 Pkg., carr. and ins. Data sheets supplied.

"MASTERADIO" VIBRATOR PACK
6 v. input 180 v. 35 mA. output complete with valve rectifier and leads. 39/6. Plus 5/- pkg., carr.

ALUMINIUM CHASSIS 18 s.w.g.
Substantially made from Bright Aluminium, with four sides

7 × 5½ × 2in.	4/-	10 × 9 × 3in.	7/-
7 × 3½ × 2in.	3/9	12 × 10 × 3in.	7/9
9½ × 4½ × 2½in.	4/3	14 × 10 × 3in.	7/11
10 × 8 × 2½in.	5/6	16 × 10 × 3in.	8/3
12 × 9 × 2½in.	7/-	16 × 8 × 2½in.	8/-

ALUMINIUM PANELS 18 s.w.g.

7 × 6in.	1/3	7 × 4in.	1/-
9½ × 6in.	1/8	9½ × 4in.	1/5
10 × 9in.	2/2	10 × 7in.	1/11
12 × 9in.	2/6	12 × 7in.	2/5
14 × 9in.	3/2	14 × 7in.	2/11
16 × 9in.	3/8	16 × 7in.	3/5
20 × 9in.	4/8	20 × 7in.	4/5
23 × 9in.	5/2	22 × 7in.	4/11

H.T. ELIMINATOR AND TRICKLE CHARGER KIT
All parts to construct an eliminator to give an output of 120 volts at 20 mA., and 2 volts to charge an accumulator. Uses metal rectifier, 37/6.

Famous Manufacturer's Surplus of
ANTI-INTERFERENCE AERIALS
offered at a fraction of original cost

The aerial is designed for reception of long, medium and short waves, with any ordinary or communications receiver, having an input impedance greater than 1,000 ohms long/medium waves and 150 ohms short waves. The installation discriminates against locally generated electrical interference, especially on the short wave bands. The equipment enables the installation of an 8.3 Mc/s flatly-tuned dipole which operates as a "T" aerial on medium and long waves. The aerial and receiver transformers are intended to be interconnected with a 70 ohms co-axial cable.

COMPONENT PARTS
Aluminium Aerial Transformer Assembly. Comprising one each: Aluminium transformer, Transformer clip, Rubber sucker, ¼in. × ¼in. brass screw, 4AB × ½in. brass bolt, 4BA nut.
Receiver Transformer. Complete with Insulators, clips, etc.; Porcelain Insulators, 2 each, 60ft. Insulated Aerial Wire, 60ft. Screened Co Axial Down lead.
Installation instruction leaflet included.
LESS CO-AXIAL CABLE & AERIAL WIRE, 15/-, plus 1/6 pkg. and carr.
COMPLETE 35/-, plus 1/6 pkg. and carr.

GARRARD Rim Drive 78 r.p.m., complete with magnetic pick-up and turntable £5/19/6
Packing and carriage on the above unit 2/6

MAINS NOISE ELIMINATOR KIT
Two specially designed chokes with three smoothing condensers with circuit diagrams. Cuts out all mains noise. Can be assembled inside existing receiver. 4/11. plus 6d. pkg. and carr.

Germanium Crystal Diodes. G.E.C. wire ended. 2/6 24/- doz.

Announcing the **PREMIER PERSONAL PAYMENT** *plans!*

★ **CASH, CREDIT OR HIRE PURCHASE** ★

★ **CREDIT** A deposit of ⅓ of cash price secures the equipment, and the balance plus charges is spread over 9 equal payments.

★ **HIRE PURCHASE** A deposit of ⅛ of the cash price secures the equipment, and the balance plus charges is spread over 12 monthly payments.

A selection of recommended items is detailed below.

TAPE RECORDERS	CASH PRICE	CREDIT SALE Deposit	CREDIT SALE 9 equal payments of	H.P. TERMS Deposit	H.P. TERMS 12 monthly payments of
Grundig TK9 ..	£68 5 0	£8 10 0	£7 9 5	£22 15 0	£4 8 8
Premier Portable	£40 19 0	£5 2 6	£4 9 7	£13 13 0	£3 11 2
Premier Table ..	£36 10 0	£4 11 3	£3 19 11	£12 3 4	£3 5 8
Wearite Tape Deck	£35 0 0	£4 7 6	£3 16 7	£11 13 4	£2 3 9
Truvox Tape Deck	£23 2 0	£2 17 9	£2 10 7	£7 14 0	£1 9 0
Lane Tape Deck	£17 10 0	£2 3 9	£1 15 6	£5 16 8	£1 2 10
TEST EQUIPMENT					
Avo Model 8	£23 10 0	£2 18 9	£2 11 5	£7 16 8	£1 9 5
Avo Model 7 ..	£19 10 0	£2 8 9	£2 2 8	£6 10 0	£1 5 0
Universal Mk. II	£10 10 0	£1 5 8	£1 4 9	£3 10 0	15 0
Electronic Meter	£40 0 0	£5 0 0	£4 7 6	£13 6 8	£2 10 0
Wide Band Signal Gen.	£30 0 0	£3 15 0	£3 5 8	£10 0 0	£1 17 6
Advance					
H.1 Signal Gen.	£25 0 0	£3 2 9	£2 14 8	£8 6 8	£1 11 3
E.2 Signal Gen.	£28 0 0	£3 10 0	£3 1 3	£9 6 8	£1 15 0
J.1 Signal Gen.	£35 12 0	£4 9 0	£3 17 11	£11 17 4	£2 4 6
P.1 Signal Gen.	£19 19 0	£2 9 10	£2 3 8	£6 13 0	£1 5 6
CABINETS					
Premier Televisor	£13 10 0	£1 13 9	£1 10 8	£4 10 0	18 4
SPEAKERS					
Wharfedale					
Super 12/C S/M	£17 10 0	£2 3 9	£1 18 6	£5 16 8	£1 2 10
W10/C8 (S) ..	£12 6 6	£1 10 10	£1 8 5	£4 2 2	17 0
Goodmans					
Axiom 72	£14 14 0	£1 16 9	£1 13 0	£4 18 0	19 8
Axiom 150	£10 5 6	£1 5 9	£1 4 5	£3 8 6	14 6

SPEAKERS (Continued)	CASH PRICE	CREDIT SALE Deposit	CREDIT SALE 9 equal payments of	H.P. TERMS Deposit	H.P. TERMS 12 monthly payments of
Vitavox K12/20	£11 11 0	£1 9 0	£1 6 11	£3 17 0	16 2
AMPLIFIERS					
Leak TL.10	£28 7 0	£3 11 0	£3 2 0	£9 9 0	£1 15 6
Point 1. TL.12 ..	£28 7 0	£3 11 0	£3 2 0	£9 9 0	£1 15 6
Point 2. TL.25 ..	£34 7 0	£4 7 0	£3 15 0	£11 9 0	£2 2 11
Vari-slope Pre-amp	£12 12 0	£1 11 6	£1 8 11	£4 4 0	17 4
Type V8RF Tuner	£35 1 3	£4 7 8	£3 16 8	£11 13 9	£2 3 10
E.A.P. Tape Recorder Amp...	£15 0 0	£1 17 6	£1 13 7	£5 0 0	£1 0 0
RECORD PLAYERS					
Regentone "Handy Gram" HG2	£15 15 0	£1 19 6	£1 15 1	£5 5 0	£1 0 10
Champion "Reveller" ..	£14 14 0	£1 16 9	£1 13 0	£4 18 0	19 8
Decematic	£24 3 0	£3 0 5	£2 12 10	£8 1 0	£1 10 2
Stella ST.50A..	£10 10 0	£1 5 8	£1 4 9	£3 10 0	15 0
RADIO SETS, CHASSIS					
Champion "Mayflower" Bat. Portable	£13 2 6	£1 12 10	£1 9 11	£4 7 6	17 10
Radio Gram. Chassis as advertised on page 70.....	£13 19 6	£1 15 0	£1 11 8	£4 13 2	18 11

It's the MAGIDISK that does it!

Automatically handling 10 Records 7", 10" and 12", with 3 seconds changeover, providing uninterrupted armchair entertainment for up to 5 hours—that's the Monarch 'Magidisk' performance! Tested and proved reliable by radiogram manufacturers, applauded by gramophone experts, this unique feature is only one of the many attributes for enthusiasts in the Monarch Record Changer. It is the leading automatic electrical high fidelity record reproducer which is giving pleasure to millions all over the world.

10 IMPORTANT ATTRIBUTES

★Plays 10 mixed diameter records at 33⅓, 45 or 78 r.p.m.
★'Magidisk' automatically selects 7", 10" and 12" discs.
★Pick Up returned and motor switched off after last record.
★Extended frequency range dual sapphire styli Pick Up.
★Simple unit control 'ON', 'OFF', 'REJECT' and speed switch.
★Fitted anti-acoustic feed back suspension springs.
★Compact overall dimensions ideal for radiogram, T.V. console and portable player.
★Turntable rim driven by vibration damped induction motor eliminating rumble and 'wow'.
★10" diameter heavy steel recessed turntable with rubber mat.
★Beautifully styled smooth, modern lines: faultless finish.

BSR MONARCH

THE WORLD'S FINEST AUTOCHANGER

BIRMINGHAM SOUND REPRODUCERS LTD., OLD HILL, STAFFS., ENGLAND

Wireless World

RADIO, TELEVISION AND ELECTRONICS

44th YEAR OF PUBLICATION

Managing Editor: HUGH S. POCOCK, M.I.E.E.
Editor: H. F. SMITH

JULY 1954

In This Issue

EDITORIAL COMMENT 307
SHIPS' LIFEBOAT RADIO 308
WORLD OF WIRELESS 309
DEVELOPMENTS IN SOUND REPRODUCTION 313
METAL FILM RESISTORS 318
EUROPEAN TELEVISION. By *J. Treeby Dickinson* 319
TELEVISION I.F. INQUIRY. By *G. H. Russell* 322
LETTERS TO THE EDITOR 325
VECTOR DIAGRAMS AGAIN. By "*Cathode Ray*" 327
WIDE-BAND COMMUNICATION RECEIVER 333
SHORT-WAVE CONDITIONS 334
NEGATIVE RESISTANCE. By *Thomas Roddam* 335
THE DIODE RECTIFIER IN VALVE VOLTMETERS—2. By *M. G. Scroggie* 339
LONG-DISTANCE V.H.F. RECEPTION 343
PIEZOELECTRIC CRYSTALS—2. By *S. Kelly* 345
CONGRESS ON SOUND RECORDING—PARIS 1954. By *H. J. Houlgate* 348
INTEGRATED MICROWAVE TEST BENCH 351
MANUFACTURERS' PRODUCTS 352
RANDOM RADIATIONS. By "*Diallist*" 354
UNBIASED. By "*Free Grid*" 356

PUBLISHED MONTHLY (last Monday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. *Telephone*: Waterloo 3333 (60 lines). *Telegrams*: "Ethaworld, Sedist, London." *Annual Subscription*: Home and Overseas, £1 7s. 0d. U.S.A. $4.50. Canada $4.00. BRANCH OFFICES: *Birmingham*: King Edward House, New Street, 2. *Coventry*: 8-10 Corporation Street. *Glasgow*: 26a Renfield Street, C.2. *Manchester*: 260 Deansgate, 3.

VALVES, TUBES & CIRCUITS

19. ECC85: COMBINED R.F. AMPLIFIER AND MIXER FOR BAND II F.M. RECEPTION

Preliminary Valve Data

HEATER

V_h	6.3	V
I_h	0.435	A

CAPACITANCES

*C_{a-g}	1.5	pF
*$C_{g-(k+h+a)}$	3.0	pF
*C_{a-k}	0.17	pF
*$C_{a-(k+h+g)}$	1.2	pF
**$C_{a'-(k'+h+g)}$	1.9	pF
**$C_{a''-(k''+h+g)}$	1.8	pF
$C_{a'-a''}$	<0.04	pF
**$C_{a'-a''}$	<0.008	pF
$C_{a'-k''}$	<0.008	pF
$C_{g'-a''}$	<0.003	pF
$C_{a'-g''}$	<0.008	pF
$C_{a''-g'}$	<0.008	pF
$C_{a''-k'}$	<0.008	pF
$C_{g'-k''}$	<0.003	pF
$C_{g''-k'}$	<0.003	pF

*Each section
**Measured with an external shield

CHARACTERISTICS

V_a	250	V
I_a	10	mA
V_g	−2.3	V
g_m	6.0	mA/V
μ	57	

OPERATING CONDITIONS

R.F. Amplifier

V_b	250	V
V_a	230	V
I_a	10	mA
V_g	−2.0	V
g_m	6.0	mA/V
r_a	9.0	kΩ

Self-Oscillating Mixer

V_b	250	V
R_a	12	kΩ
R_{g-k}	1.0	MΩ
I_a	5.2	mA
$V_{osc(r.m.s.)}$	3.0	V
g_c	2.3	mA/V
r_a	20	kΩ

LIMITING VALUES (each section)

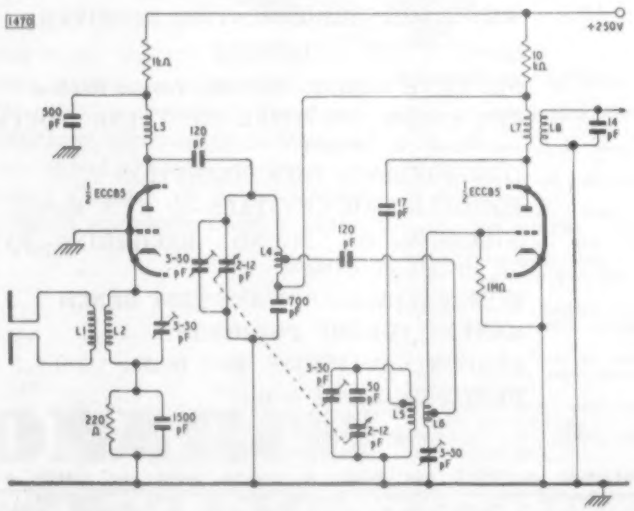
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.5	W
$p_{a'}+p_{a''}$ max.	4.5	W
I_k max.	15	mA
$-V_g$ max.	100	V
R_{g-k} max.	1.0	MΩ
V_{h-k} max.	90	V
R_{h-k} max.	20	kΩ

BASE B9A

It is essential when designing F.M. receivers for operation at V.H.F. to reduce noise in the input stages and radiation from the local oscillator by including an R.F. amplifier before the frequency changer. A triode is preferred for the R.F. stage because it has better noise properties than a pentode. The Mullard double triode type ECC85 has been specially designed for the 'front-end' stages in F.M. reception. One triode section is used as the low-noise amplifier and the other triode section follows it as a self-oscillating additive mixer. With this arrangement both oscillator radiation and noise are reduced by feeding the signal from the R.F. stage to a null point on the oscillator coil.

The outstanding feature of the ECC85 is that extensive internal screening has been provided to reduce the capacitance between the anodes to less than 0.04 pF, so that in a suitable circuit the oscillator radiation can be made lower than with any double triode previously available. This capacitance can be reduced to less than 0.008 pF by surrounding the valve with a screening can 22.5 mm in diameter. The front-end stages are thus separated effectively without the cost of using two separate triodes. These measures are completely satisfactory in reducing oscillator radiation to an acceptable value, since only a relatively low oscillator voltage is required to drive the mixer. In addition to having high slope and input resistance, the ECC85 has an amplification factor of 57.

A typical circuit for the ECC85 is given below in which the R.F. section is operated with a grounded grid and the mixer with a grounded cathode. A grounded-grid circuit has the advantage of being more easily adjusted than one which requires special measures to neutralise the anode-to-grid capacitance. Any additional gain which might be obtained from more complex circuits is not necessary, and in fact the input coils L1, L2 can be matched for minimum noise rather than maximum power. The frequency changer input is taken from a tap on the R.F. coil, L4, in order to increase the R.F. gain and also to ensure that the required frequency range is covered by the 2-12 pF tuning capacitor. The oscillator circuit is anode-tuned and is coupled to the anode by a 17 pF capacitor which because it presents a low impedance to an intermediate frequency of, say, 10.7 Mc/s also tunes the I.F. transformer. Internal anode-to-grid capacitance in the mixer triode, which might reduce the amplification, is neutralised by applying an I.F. feedback voltage to the grid.



Reprints of this advertisement together with additional data may be obtained free of charge from the address below:

MULLARD LTD., Technical Service Department, Century House, Shaftesbury Avenue, W.C.2

MVM 283

Wireless World

JULY 1954 VOL. 60 No. 7

Radio Licences

LAST month we entered a mild protest about the new G.P.O. radio licence regulations, drawing attention to certain anomalies and irrelevancies. In particular, we complained that the licence fees charged for broadcast sound and vision reception in guest rooms of hotels were excessively high. According to the regulations, the full domestic fee is to be paid for each room equipped.

We are now told, in effect, that the "Statutory Instrument" under which these regulations were made must not be taken too literally. The wording of the Post Office official statement on this subject is somewhat vague, but apparently the regulation applies only to "permanent" residents; most transient occupants of hotel rooms may be assumed to have already a licence for their home installations. And, anyway, the onus of seeing that his set (or extension loudspeaker) is licensed is apparently on the guest; not on the hotel proprietor.

What is a "permanent" guest? A person normally resident abroad is, we believe, liable to be caught up in the U.K. tax net after a stay of six months in this country. It sounds reasonable, therefore, to suggest that, after the same period, the hotel guest, whether British or foreign, might be held liable to pay for a broadcast licence. But how many people stay in the same hotel for six months or longer? Not enough, we should guess, to justify this rigmarole of the so-called Comprehensive Hotels Licence. The comparatively rare case of the "permanent" hotel guest could easily, and administratively much more simply, have been covered by adding a few words to the regulations covering ordinary domestic licences.

We are forced to the conclusion that the Post Office, over-anxious to regularize its position with regard to the whole question of licences, has rushed through the new regulations without sufficient thought. Not only has the hotel licence already become virtually a dead letter; it has been found necessary to alter the conditions under which apparatus for the radio control of models may be operated. Further, it appears that the terms of the licence appropriate for this purpose were framed without consultation with the bodies concerned. Indeed, it would seem that the only body of radio users to express satisfaction with the new licence regulations are the transmitting amateurs, who, as reported last month, have been granted some small concessions.

Television for Posterity

IT is being increasingly borne home to all of us that in choosing standards for a public television service we are acting as trustees for posterity. When a system is once firmly established it becomes, almost inevitably, a standard for all times. At the least, it will have a profound influence on technical developments for many decades ahead. All progress tends to be handicapped by the need for "compatibility"; the new system must be able to work with the old.

Even to hint at the possibility of a non-compatible successor to the present British system has, until recently, been considered unrealistic, idealistic or "starry-eyed." But now there are faint signs of a revolt against the dogma of compatibility, and a correspondent whose letter is published elsewhere in this issue does not hesitate to say "it may tie a weight round the neck of every receiver designer for the next century." He refers to compatibility in relation to colour television.

Wireless World has often been impatient when artificial barriers are put in the way of progress in the various branches of our art. But, in this matter, we are on the side of those who believe in making haste slowly. To start colour television before a really practical solution of the many technical difficulties has been found would be foolish. A policy of "anything so long as it is colour" is to be deplored; so are irresponsible statements that the public may expect colour television within a year or two.

In the meanwhile, no effort should be spared in exploring all the technical possibilities for the future and in planning, with all the wisdom we can command, for orderly development of the service.

SHIPS' LIFEBOAT RADIO

On the left is shown the kite just after launching : at its normal working height the aerial wire is more nearly vertical. The fixed inverted-V aerial is carried by a resin-bonded fibre-glass mast. Above is the SOLAS lifeboat set, with front cover removed.

AN improved kind of kite is one of the accessories of a transmitter-receiver for ships' lifeboats, recently type-approved by the G.P.O. and Ministry of Transport, which has been produced by the International Marine Radio Company. Kites have been used for raising wireless aerials ever since Marconi's transatlantic experiments of 1902, but have been generally considered unreliable: the new design produced by I.M.R.C. seems to represent a distinct advance, and is easily launched from the restricted platform provided by a ship's lifeboat. The kite flies well in winds of five or six miles an hour, and, by lifting an aerial wire to a height of about 200ft, provides a radio-communication range vastly greater than that attainable with any practicable mast-supported lifeboat aerial. During recent tests, daylight ranges of over 500 miles were achieved with average radiated power as low as 4 watts—a rather remarkable performance, considering the tests were carried out in Southampton Water, where heavy interference prevails.

The I.M.R.C. "SOLAS" (Safety Of Life At Sea) set transmits on the international distress frequencies of 500 kc/s and 8.634 Mc/s. There is clockwork-driven automatic keying for the alarm signal, SOS, and direction-finding dash, with hand-keying as an alternative. Telephone modulation is also provided. Reception is on 500 kc/s only. The set is powered entirely by a hand-turned generator; an extra crank is provided so that the work may be shared by two men.

For transmission, the three valves work as master oscillator, power amplifier and modulator; modulation for m.c.w. telegraphy is square-wave, giving the wide-band characteristics desirable for distress calls. The note is distinctive and readable through interference. There is a tuning indicator as an aid to adjusting the aerial circuit; this is needed for obtaining maximum radiation under all conditions, as a fixed aerial supported by an 18ft mast is used as an alternative to the kite aerial.

For reception, two of the valves become r.f. amplifiers and the third an a.f. amplifier; there is a germanium diode detector. An external crystal receiver can be provided; this permits listening without turning the generator.

The set is contained within a completely waterproof light alloy case which can withstand rough handling. The spindles of the controls work in waterproof sleeves, so the gear can be operated in bad weather with the front cover removed.

TRANSISTORS FOR HIGH FREQUENCIES

AN inherent limitation of the first junction transistors was the comparatively low frequency at which a sudden deterioration of current gain sets in (the so-called alpha cut-off). The physical cause of this cut-off is complex, but is generally accepted as being related, among other things, to the transit time of current carriers at the base-collector junction.

In practice the frequency at which cut-off occurs can be increased by reducing the width of the centre base section of the junction, but this involves expensive manufacturing techniques and may have adverse effects on other desirable parameters of the transistor.

An alternative method of construction is described by J. M. Early in the May, 1954, issue of *The Bell System Technical Journal*. Essentially it involves the interposition of a layer of high-purity germanium between base and collector, which is described as a depletion layer and has the attributes of a space charge. In addition to reducing the effective base-collector capacitance and increasing the reverse breakdown voltage, it also results in an increase in the mobility of current carriers through this region. The germanium in this layer is said to have intrinsic conductivity, that is to say, the available current carriers are not supplemented by donor impurities (giving negative electrons, *n*) or acceptor impurities (creating positive holes, *p*). Hence the description *p-n-i-p* or its converse *n-p-i-n*.

Experimental transistors, constructed on this principle with 0.002-in thick *i*-type layers, have oscillated up to a frequency of 95 Mc/s. Theoretically, with improved materials and geometrical forms, it is stated that there is a prospect that they may be made to work up to 3,000 Mc/s.

WORLD OF WIRELESS

B.B.C. in Band III • More V.H.F. Transmitters Ordered • Television for Jersey • Electronics Convention and Show

Band III Television

BOTH the component and receiver manufacturing sections of the industry (represented by R.E.C.M.F. and B.R.E.M.A.) have recommended the standardized use of a single input of 75 ohms for both Bands I and III. This is a long-term policy to which both receiver and aerial manufacturers will work, but it is pointed out that in the interim there will be some installations for which two inputs will be necessary.

It is understood that pulsed test signals in Channel 8 (186-191 Mc/s) are already being radiated by the B.B.C. from Sutton Coldfield. Sir Ian Jacob has said that the B.B.C. is ready to put into operation its scheme for a second programme as soon as frequencies become available.

B.B.C. Awaits Green Light

ALTHOUGH official approval of the B.B.C.'s plan to reinforce the present coverage of the Home, Light and Third Programme Services with v.h.f. transmissions is still awaited, the Corporation is continuing to place orders for equipment.

A further order for 14 v.h.f. frequency-modulated transmitters has been placed with Marconi's. This brings the total number of transmitters now on order to 64 (40 Marconi and 24 S.T.C.). With the exception of two, which will have a power of 10 kW, the transmitters will be rated at 4.5 kW.

Since the Government decision that f.m. should be used for the proposed v.h.f. service, both experimental transmitters at Wrotham have been employing frequency modulation. The present schedule is Mondays to Thursdays 11.15-12 noon, 1-2 p.m. and 2.45-4.30 p.m.; every day except Friday 6 p.m. until the close down of the service being radiated. The Home Service is radiated on 93.8 Mc/s and the Light Programme (until 4.30) and the Third Programme (from 6) are radiated on 91.4 Mc/s.

Tests of tone modulation with various peak deviations are radiated from 11 to 11.15 and 2.30 to 2.45 (Mondays to Thursdays) on both frequencies.

Industrial Electronics

THE five-day industrial electronics convention organized by the Brit.I.R.E., which opens at Christ Church, Oxford, on July 8th, has aroused considerable interest in many industries, including aircraft, electrical, film, glass, iron and steel, motor, oil and rubber, all of which will be represented.

Thirty-two papers will be presented and discussed during the six sessions—Industrial Applications of Electronic Computors (chairman, L. H. Bedford), Industrial Applications of X-Rays and Sonics (H. G. Foster), Nucleonic Instrumentation and Application (N. C. Robertson), Electronic Sensing Devices—Transducers (Prof. E. E. Zepler), Process Control (J. L. Thompson), Electronic Aids to Production (Sir Walter Puckey). The papers and a verbatim report of the discussions will be published by the Institution.

Channel Islands TV

DIRECT reception of the Wenvoe and Alexandra Palace transmitters will be relied upon for the television "booster" service which the B.B.C. plans to introduce in the Channel Islands within a year. The distances between these stations and the receiving centre to be set up at Torteval on the south-west coast of Guernsey, are approximately 130 and 190 miles, respectively.

The picture received in Guernsey on the alternative aerial systems directed towards the two stations will be transmitted by radio link to Les Platons on the north coast of Jersey—some 20 miles away. There a low-power transmitter working on 61.75 Mc/s vision and 58.25 Mc/s sound will re-broadcast a service to the group of islands. The transmissions will be horizontally polarized.

Rediffusion is planning to install a television wire distribution service in Jersey.

Radio Control of Models

THE LICENCE now required for the operation of radio equipment for the control of models has been criticized by the International Radio Controlled Models Society, and, as a result of meetings with the G.P.O., some concessions have been made and obscure rulings interpreted.

The maximum effective radiated power, which is the mean r.f. power multiplied by the aerial gain in the horizontal plane, was originally limited to 0.3 W. This has now been raised by the Post Office to 0.5 W when working on 465 Mc/s and 1.5 W on 27 Mc/s.

Although not permitted under the original provisions of the new licence, operation of equipment by other people under direct supervision of the licensee will now be allowed.

Earl's Court

PLANS for the National Radio Exhibition (Earl's Court, August 25th-September 4th) are going ahead and the preliminary list of exhibitors totals 107. Of this number some 40 are manufacturers of domestic sound and vision receivers.

The technical training display will be more ambitious than in past years. It will include sections devoted to machine-shop practice, components, glass manipulation, circuitry and aerials. Also the Radio Trades Examination Board has been invited to organize a section illustrating radio servicing.

Electronics Show

THE ninth annual electronics exhibition organized by the N.W. Branch of the Institution of Electronics, will be held at the College of Technology, Sackville Street, Manchester, from July 14th to 20th.

The exhibition will be divided into two main sections—research, composed of displays by universities, research organizations, hospitals, etc., and commer-

cial, devoted to the products of over 50 manufacturers.

A programme of 40 lectures has been arranged for presentation during the exhibition, which opens at noon on the 14th and at 10 on other days and closes at 10 except on the 17th, when it closes at 7.

Tickets are obtainable by sending a stamped-addressed envelope to W. Birtwistle, 78, Shaw Road, Thornham, Rochdale, Lancs., from whom the 100-page exhibition catalogue, which includes the time-table of lectures, is also obtainable, price 1s 6d.

BIRTHDAY HONOURS

Among those whose names appeared in the Birthday Honours List are:—

C.B.

W. A. Wolverson, director, External Telecommunications Executive, G.P.O.

K.C.M.G.

Major General L. B. Nicholls, chairman, Cable & Wireless, Ltd.

M.V.O.

Lt. T. D. Grosset, Royal Navy (Shore Wireless Service).

C.B.E.

T. E. Goldup, director of Mullard, Ltd. (see "Personalities").

O.B.E.

W. E. Cleaver, manager, Cable & Wireless Engineering School, Porthcurno, Cornwall.

F. M. Colebrook, senior principal scientific officer, National Physical Laboratory, D.S.I.R. (see "Personalities").

M.B.E.

F. N. Calver, engineer-in-charge of the Daventry transmitting station, B.B.C.

R. H. J. Cary, senior experimental officer, Radar Research Establishment, Malvern.

I. A. Dalgliesh, chief radio officer, British European Airways.

R. B. Hosking, signals officer, Ministry of Transport and Civil Aviation.

R. D. Lanser, superintendent of radio maintenance, British Overseas Airways Corporation.

S. H. Lines, general works manager, A. C. Cossor, Ltd.

A. I. F. Simpson, senior engineer, General Electric Company (see "Personalities").

PERSONALITIES

Colonel A. H. Read, C.B., O.B.E., who, as announced in our May issue, recently retired from the Post Office where he was director of Overseas Telecommunications,

Cdr. C. M. JACOB

K. SHORT

has taken up an appointment as Telecommunications Attaché at the British Embassy in Washington.

Colonel J. D. Haigh was recently appointed director of Electronics Research and Development (Defence) in the Ministry of Supply and promoted acting Brigadier. He has already served in this directorate (1946-50) when it was known as the Directorate of Telecommunications Research and Development. Since October of last year Col. Haigh has been employed on fuze design at the Armament Design Establishment, Fort Halstead.

Group Captain P. Allerston, O.B.E., M.I.E.E., recently appointed manager of the new Equipment Servicing Department of A. C. Cossor, Ltd., was concerned with the inauguration of the original Gee programme during the war. From 1946 to 1949 he was Deputy Director of Radio Engineering (Air) at the Air Ministry. In his new post he will be responsible for the installation and maintenance, both at home and overseas, of Cossor's airfield control radar, Gee ground and airborne equipment and other radio and radar gear.

Commander C. M. Jacob, D.S.C., A.M.I.E.E., R.N. (Ret.), recently appointed deputy technical manager of the Marconi International Marine Communication Company, specialized in radio and radar during the greater part of his naval career, which began in 1923. In 1939 he was appointed to the Home Fleet as fleet wireless officer and fleet radar officer. Since the end of the war he has held a number of shore appointments, including that of deputy captain-superintendent of the Admiralty Signal and Radar Establishment.

K. Short, D.L.C. (Hons.), A.M.I.E.E., who joined Truvox during the war and has been chief engineer since 1950, has been appointed technical director of the company. He studied at Loughborough College for five years, receiving a first-class honours diploma, and returned to the college for a further year in 1948.

T. E. Goldup, M.I.E.E., who has been a governor of the Ministry of Supply's School of Electronics at Malvern since 1949 and chairman of the Board of Governors for the past two years, is among the new C.B.E.s. Mr. Goldup is a director of Mullard, whom he joined in 1923. He was a member of the Radio Research Board of D.S.I.R. from 1950 until March this year, and was chairman of the Radio Communication and Electronic Engineering Association for 1953-54.

F. M. Colebrook, B.Sc., D.I.C., A.C.G.I., who is appointed an O.B.E., has been on the staff of the National Physical Laboratory, Teddington, since 1920. Since 1949 he has been officer-in-charge of the Electronics Section, prior to which he was deputy superintendent of the Radio Division. Mr. Colebrook is on the editorial board of our sister journal *Wireless Engineer* and has been a contributor to both *W.W.* and *W.E.* for the past 30 years. He is the author of "Basic Mathematics for Radio Students" published from this office.

A. I. F. Simpson, appointed an M.B.E., has been engaged in the design of radio equipment in the Coventry group of the G.E.C. for the past 19 years. Since the war he has been leading teams on various government projects, including one on the remote control of aircraft. Towards the end of the war he led the engineering team working on airborne, multi-channel radio-telephone equipment.

Joshua Sieger, who has been in the United States since the end of 1946, has returned to this country and proposes to continue his consulting work in radio and electronics. From 1930 to 1939 he was with Scophony and during the major part of the war was principal technical officer at T.R.E. During his stay in America he has acted as consultant and directed the research and development of aeronautical radar equipment and television gear. He was a member of two of the planning committees of the National Television Systems Committee, which established principles for a compatible colour system. Mr. Sieger's address is "Montcalm," Cliff Drive, Canford Cliffs, Bournemouth, Hants.

Stanley Kelly, whose article on piezoelectric crystals is concluded in this issue, has resigned the post of chief engineer with Cosmocord, Ltd., and has been appointed technical director of Thames Industries, Ltd., 143, Cannon Street, London, E.C.4, manufacturers of chemical and scientific equipment.

A. W. Montgomery, O.B.E., B.Sc., M.I.E.E., joint general manager of Standard Telephones and Cables, has been elected a Fellow of the American Institute of Radio Engineers for his "leadership in radio and telecommunication research in England, and his services in the international liaison in these fields." During the war he was engaged on the development of this country's defence teleprinter network and communication equipment.

Fred R. Lesser, formerly overseas sales manager, Goodmans Industries, Ltd., is now operating on his own account as representative of manufacturers of radio and electronic equipment and components. His address is 66, Holland Park Avenue, London, W.11 (Tel.: Bayswater 6792).

IN BRIEF

Television Licences in the U.K. increased by 51,946 during April, bringing the total to 3,300,838. The number of broadcast receiving licences, including television and 229,542 for car radio sets, totalled 13,455,061.

Receiver Oscillator Radiation.—Reports continue to be received that oscillation radiation from television receivers is causing considerable trouble on some of the v.h.f. bands and it is a pity the Admiralty's lead in regard to naval receivers cannot be more widely applied. A rigid requirement is imposed in regard to oscillator radiation from both set and aerial, the specified level being less than 0.1 μV/m at one nautical mile. Incidentally, the Rees Mace naval set, CAT, described elsewhere in this issue, fully complies with this requirement.

Ships' Newspapers.—The jubilee of the first regular daily newspaper to be published in transatlantic liners was celebrated by *Ocean Times* on June 4th. It was first published on R.M.S. *Campania* in 1904 as the *Cunard Daily Bulletin*. News collated from many sources is sent from the London office of the publishers, Wireless Press, Ltd., via the Rugby radio station, and similar dispatches are sent from New York.

Television as an advertising medium, and the problems facing advertisers using the medium, are dealt with in a booklet, "**Advertising by Television,**" issued by TV Commercials, Ltd., of 35, Portland Place, London, W.1. The new company will provide advertisers with technical as well as programme services for television advertising. Among the directors is Richard Meyer, who was from 1930 to 1940 general manager of the International Broadcasting Company, organizers of commercial programmes from Radio Normandy and Radio Luxembourg.

French F.M.—The French broadcasting authority, Radiodiffusion et Télévision Françaises, is to introduce a v.h.f. service based on the Stockholm Plan, which provides for some 170 French stations in Band II. Regular transmissions have been radiated from the new Paris f.m. station since the end of March. The 5-kW transmitter, with an e.r.p. of 20 kW, radiates on 96.1 Mc/s.

A further step in the plan to improve the coverage of the **Home Service** was taken by the B.B.C. on May 30th when the permanent 2-kW transmitter at Barrow-in-Furness took over from the 0.5-kW temporary station set up some time ago. It radiates on the international common frequency of 1484 kc/s (202.2 metres).

Television Society.—At the annual general meeting of the Television Society on May 27th the following were elected to fill the vacancies on the council: C. H. Banthorpe (Derwent Radio); J. H. Etheridge (Cinema-Television); H. A. Fairhurst (Murphy Radio); and E. A. Wood (Radio Rentals).

Radio Industries Club membership stood at 841 at the end of March—an increase of 47 during the year. The new president is C. O. Stanley, managing director of Pye, Ltd., and this year's chairman is R. F. Payne-Gallwey.

Acknowledgement.—The photograph of the *Sir John Cass*—the training vessel of the Navigation Department of the Sir John Cass College—reproduced in our last issue should have been acknowledged to *Motor Boat and Yachting*.

Mobile Radio.—The Postmaster-General has set up a committee to "examine the practical problems which the Television Advisory Committee's first report [on television] raises in relation to the mobile radio services." The Mobile Radio Committee, as it is called, which is under the chairmanship of R. J. P. Harvey (G.P.O.), includes two representatives of the Post Office, Ministry of Transport and Mobile Radio Users' Association, and a representative of marine users. Capt. L. P. S. Orr, M.P., and J. R. Brinkley (Pye Telecommunications) are representing the M.R.U.A. One of the Post Office representatives is C. W. Sowton, who is secretary of the T.A.C. Technical Sub-Committee.

EDUCATION AND TRAINING

Transistor Course.—Dr. G. N. Patchett, head of the Department of Electrical Engineering of the Bradford Technical College, is giving a course of eight lectures on the principles and applications of transistors at the college in the autumn. The fee for the eight lectures, which will be given on Wednesday evenings from September 29th, is £1 10s. Students should have reached the standard of the H.N.C. in electrical engineering.

Radio Recruiting.—A brief outline of the opportunities open to those who enter the radio and electronics industry and of the qualifications needed is given in "Careers in Radio and Electronics," a 12-page booklet issued by the Radio Industry Council. It is for free circulation to schools and technical colleges, and is obtainable from the R.I.C., 59, Russell Square, London, W.C.1.

"**Careers in Engineering,**" an 18-minute film made by the English Electric Company, portrays the training available to the three grades of apprentice—craft, student and graduate—through the English Electric group of companies, which includes Marconi's. The 16-mm sound film, which is available on loan to technical colleges, schools, etc., covers the various branches of engineering including telecommunications and electronics. Further details of the company's apprenticeship schemes are given in two booklets entitled "Earning While Learning" and "Opportunities for University Graduates."

Details of **Day and Evening Courses** in radio, television and electronics provided by the Department of Telecommunications Engineering of the Northern Polytechnic, London, N.7, are given in the 1954-55 prospectus, which is obtainable from the secretary.

INDUSTRIAL NEWS

Birmingham's new **Engineering Centre** at Stephenson Place, which was opened on June 17th, provides a permanent exhibition for the display of engineering equipment. Kelvin & Hughes (Industrial), Ltd., are showing an electronic controller for the regulation of temperature in furnaces, dye vats, heat exchangers, etc.

To facilitate rescue operations in the 111 collieries under the jurisdiction of the N.W. Division of the National Coal Board, the vehicles used by the mines rescue service have been fitted with **G.E.C.** v.h.f. radiocommunication equipment. Fixed stations have been installed at Boothstown (the headquarters of the service), Burnley and Wrexham.

A chain of **Decca** stations has been erected in the Sahara Desert to assist in a survey of some hundreds of square miles for oil.

Marconi Organization.—G. R. Tyler has been appointed manager of the recently-formed Maritime Division of Marconi's W.T. Company. He is succeeded as manager of the company's Central Division by R. H. Deighton. Chief engineer of the new division is J. Watt, B.Sc. (Hons.), D.I.C. The company's Services Equipment Division will in future be known as the Radar Division, of which H. J. H. Wassell, O.B.E., B.Sc. (Hons.), has been appointed chief engineer.

Among the four cable ships for which **Mullard's Equipment Division** is supplying "Discovery" direction-finding equipment is the *Monarch*, being refitted by the Post

Office in readiness for the laying of the transatlantic telephone cable.

Minnesota Mining & Manufacturing Company, whose products include "Scotch Boy" sound-recording tape, have opened a sales office at 90, Mitchell Street, Glasgow, C.1 (Tel.: City 6704).

EXPORT NEWS

Colour c.r. tubes are to be manufactured in this country by a new company—**Sylvania-Thorn Colour Laboratories, Ltd.**—which has been formed jointly by Sylvania Electric Products, Inc., of New York, and Thorn Electrical Industries, Ltd., manufacturers of Ferguson receivers. Sylvania's patents and technical know-how will be available to the new company.

S.H.F. radio networks, intended for the two-way transmission of 525-line television, are being supplied by **Standard Telephones & Cables** to the Canadian Pacific and Canadian National Railways. Five unattended intermediate repeaters will link Montreal and Quebec, and three will link Toronto and London. On the latter chain two spurs will go to Kitchener and Hamilton. These radio links can provide up to seven radio channels in each direction, and each of these can be utilized for carrying a television channel or 600 telephone channels.

B.T-H. has received a third contract for mobile fire-control radar from the U.S. Army European Headquarters Command. This contract, valued at £2.02M, brings the total value of the three orders to nearly £5M. All the equipment is for N.A.T.O. countries.

Marconi-I.A.L. Contract.—By combining their manufacturing and planning resources, Marconi's W.T. Company and International Aeradio, Ltd., have jointly secured a contract from the Syrian Ministry of Defence for the planning and equipment of a complete radio communications network for the Syrian air force. The contract also includes v.h.f./d.f. stations and a training school.

Precision approach radar equipment, which provides an airfield ground controller with visual and three-dimensional information (distance, azimuth and elevation) relating to an approaching aircraft, is being installed by **Standard Telephones & Cables** at the Royal Canadian Navy's airfield at Dartmouth, Nova Scotia. Similar equipment is already in use at two Ministry of Supply airfields in the U.K., two air force stations in Holland and the international airport at Zurich.

N. American Agency Enquiries.—Manufacturers of record changers not already represented in the United States are invited by the J. M. Zamoiski Company, 110, South Paca Street, Baltimore, Maryland, U.S.A., to send them particulars of their products. A.P.M., Ltd., of 15, Bacon Street, Moncton, New Brunswick, Canada, wish to undertake the distribution of British-made television aerial accessories, including masts. (B.o.T. references ESB/10817/54, ESB/10807/54).

Exporting Amateur Gear.—The Export Services Branch of the B.o.T. advise us that W. B. Dismukes, of 125, Velarde, Albuquerque, New Mexico, U.S.A., would like to receive catalogues and price lists of British amateur transmitting and receiving equipment with a view to acting as distributor in New Mexico. Further particulars are available from the Branch at Lacon House, Theobalds Road, London, W.C.1. (Ref. ESB/13794/54.)

British manufacturers of **Television Aerials,** covering the U.S. Channels 2-13 (54-216 Mc/s), and aerial accessories are invited by C. L. Curren of Atlantic Television Distributors, Ltd., 207, Charlotte Street, St. John, New Brunswick, Canada, to send him particulars of equipment by air mail.

Marconi's recently shipped to Brazil complete sound and vision equipment for a television station in Sao Paulo. The installation included four television camera channels, a vision mixer and associated equipment.

AIDS TO MECHANICAL HANDLING

Pye v.h.f. radio-telephone installed in a "Conveyancer" truck shown at the Mechanical Handling Exhibition.

CLOSED-CIRCUIT television has a sufficiently promising future in the industrial field to warrant the commercial introduction of suitable equipment. This, in the form shown by Pye at the recent Mechanical Handling Exhibition and Convention organized by *Mechanical Handling*, consists of two units. One is a camera unit embodying a miniature camera tube measuring 6 in × 1 in, operating on the photo-conductive as distinct from the photo-emissive principle; it is known as a Cathodeon Staticon.

Focusing of the image is achieved by moving the tube and its coil assembly to or from the three-lens turret by means of gearing operated by an external knob.

The camera is entirely self-contained and includes all the tube operating circuits, power supply, pulse generators for the 405-line or 525/625-line standards (there are two models) and a v.h.f. oscillator which can be modulated by the picture and pulse signals.

Either a video, or a modulated v.h.f., output can be taken from the camera, the former for displaying on the companion picture monitor and the latter for feeding into one or more normal television receivers as required. Video signals can be taken up to 1,000 ft and the r.f. signals very much further.

The picture monitor embodies a 14-in tube with light filter and is a precision instrument designed to give a very high-quality picture.

Several of the special types of truck designed for mechanical handling of materials and the finished product were shown this year fitted with Pye v.h.f. radio telephone equipment. The set used is in most cases the "Reporter" which operates on 6 or 12 volts, gives an output of 1 to 3 watts according to which part of the 60- to 185-Mc/s band it is operating in and employs amplitude modulation.

Developments in

Sound Reproduction

NEW PRODUCTS SHOWN AT RECENT EXHIBITIONS*

THOSE who are interested in audio matters and like to gain first-hand knowledge of new products by discussion with manufacturers have long been clamouring for a comprehensive Audio Fair in this country. Until this comes about, it is necessary for the enthusiast to attend at least three exhibitions, each with some restriction either of space or objective, to be sure of getting a reasonably broad view of what is new in sound reproduction.

Accordingly, in reporting these exhibitions we believe that a single review may be of more service than a series of restricted articles on the individual exhibitions, and we make no apology for laying the emphasis on the equipment rather than on the occasion on which it was shown.

Microphones.—A directional pressure-gradient moving coil microphone, Type DPA, has been developed by Reslosound. It is of all-metal construction and employs an aluminium-magnesium alloy diaphragm 0.0005in thick with a self-supporting coil working in a 0.02in air gap. Self-damped slit cavities provide the requisite phase differences between back and front of the diaphragm, and no absorbent material is used. A spring-loaded ball joint allows 22½ degrees of movement from the vertical.

In the ribbon (Type M8) and moving coil (Type M7) microphones recently introduced by Film Industries a semi-flexible metal tube gives instant adjustment to any required position without the necessity for clamped joints. The diameter of the ribbon microphone is only 1¼in.

A new "pencil" microphone has been developed by Lustraphone. This is a miniature moving-coil type for speech and is carried on a flexible tube which can be fitted to a stand or desk mount It is designed for speech with a frequency response from 150 c/s to 10 kc/s ±4 db. The sensitivity referred to 1V/dyne/cm² is −86db. Another interesting Lustraphone product is a moving-coil microphone insert (Type C151/HMF) designed to replace the carbon microphone in standard telephone handsets for use in v.h.f. communications where reduction of background noise is important.

The inexpensive Mic 36 series of crystal microphones introduced by Cosmocord (Acos) are of attractive appearance and can be adapted for stand or desk mounting. They have an omni-directional response substantially flat from 30 to 7,000 c/s with a sensitivity of −55db referred to 1 volt/dyne/cm².

G.E.C. are now supplying an inexpensive counterbalanced boom for use with their ribbon microphone.

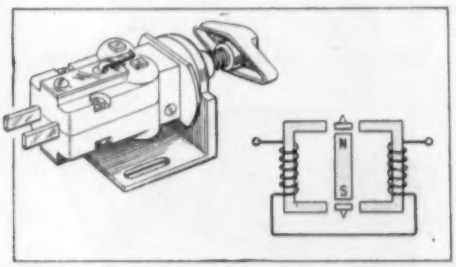
Pickups—A diamond stylus is standard in the latest moving-coil pickup developed by H. J. Leak. The response is claimed to be within ±1db from 40 to 20,000 cs. On long-playing records the high-frequency resonance is 21 kc/s ±2 kc/s and, on the shellac, above 27 kc/s. The low frequency resonance is 20 c/s ±5 c/s. Output is 11mV per cm/sec recorded r.m.s. velocity. Playing weights are 5-6 gm on 78 r.p.m. and 2-3 gm on long-playing records.

A new super-lightweight (Mark II) pickup by A. R. Sugden (Connoisseur) works on the moving-iron principle and employs a diamond stylus. The mass of the armature is only 5 milligrams and the top resonance on vinylite is in the region of 20-21 kc/s. The stylus tip is constrained longitudinally but sufficient vertical compliance is provided to overcome pinch effect, and to prevent damage if the head is accidentally dropped on the record.

Goldring, who have for many years specialized in the design of electromagnetic pickups, have introduced a "variable reluctance" (moving iron) turnover head of small size in which exceptionally wide gaps reduce non-linearity distortion. The permanent

Above: Cosmocord (Acos) Mic 36 crystal microphone.

Left: Film Industries Type M8 ribbon microphone.

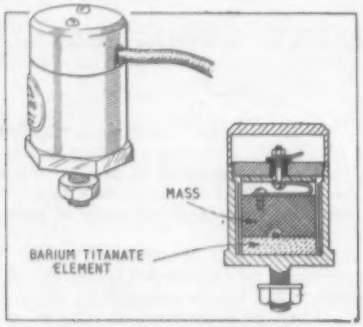


Goldring variable reluctance magnetic pickup.

* Radio and Electronic Component Manufacturers Federation, April 6th to 8th; Association of Public Address Engineers, April 28th and 29th; British Sound Recording Association, May 22nd and 23rd.

magnet is placed between the sockets of the cantilever styli which form part of the magnetic circuit. The coil arrangement cancels any hum picked up from uniform external fields.

The HGP39/1 heads now available for the GP20 Cosmocord (Acos) pickup are designed to track any accelerations which can be cut on commercial records



Acos accelerometer.

with a playing weight not exceeding 8 gm. The sensitivity of the Rochelle salt crystal element gives an output of the order of ½ volt on standard and 1/3 volt on microgroove records.

A piezoelectric pickup (GCE3) using ceramic (barium titanate) elements has been developed by Garrard and will be supplied if required for extreme tropical conditions. Acos also are actively interested in all applications of barium titanite materials and have produced a neat accelerometer unit, with this substance as the pressure element, for use in ballistics research and many other applications. It is capable of withstanding and recording accelerations up to at least 3,000 g.

Gramophone Turntables. — The latest Plessey record changer will play 10-in and 12-in records mixed, and has three turntable speeds. Attention has been given to reducing the time of changing, and since the unit is designed to take long-playing records, a lightweight pickup is fitted.

Collaro Model 2010 transcription unit and pickup.

Garrard Model 301 transcription motor.

For the reproduction of high-quality long-playing records a turntable mechanism of more than average quality is a necessity, and to meet this demand Collaro have introduced the Model 2010 which has a heavy turntable and large main bearing. Two types are available, one with a pickup arm capable of accommodating records up to 16in diameter.

The Garrard Model 301 transcription turntable has been re-tooled and will be in quantity production soon. The main bearing is machined from cast phosphor bronze and is pressure grease lubricated. Spring mounting for all controls as well as for the induction motor itself has been adopted to ensure that vibration is not transmitted to the pickup. An interlock between the main switch and speed change control ensures that the intermediate friction drive wheel is not damaged by excessive slip. Another recent product of Garrard is the Type LRS2 large record spindle, designed for use on RC110 and RC11 record changers with 7-in, 45 r.p.m. records with 1½-in centre holes.

The Swiss-made Thorens three-speed motor (E53PA) is now available in this country through the Lowther Manufacturing Company.

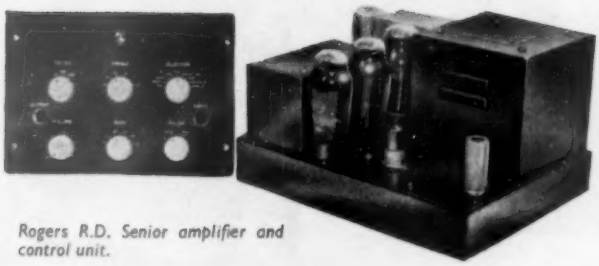
Amplifiers.—Many excellent new high-quality amplifiers have made their appearance, usually in conjunction with comprehensive tone-control units for the various recording characteristics used by record manufacturers.

In the Quad II amplifier made by the Acoustical Manufacturing Company, push-button selection of four main characteristics is provided, and other variants can be obtained by using permutations of two or more buttons. In addition, correct impedance matching for all types of pickup is obtained by changing plug-in units at the back of the unit. The system is flexible and will cope with future as well as existing developments.

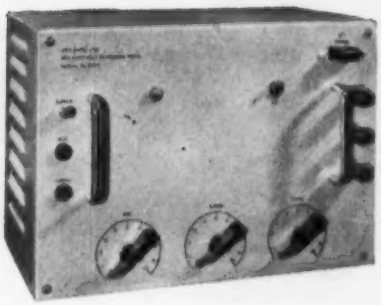
Provision is made in the control unit of the Leak TL/10 amplifier for connection to a tape recorder—either for recording or reproduction. This feature is in addition to the usual input connections for radio and records together with fixed compensating circuits for the principal disc recording characteristics and variable bass and treble controls.

Facilities for tape recording and playback are also included in the RD Senior amplifier and control unit. This amplifier, which is based on the Williamson circuit and uses a C-cored output transformer, is rated at 15 watts for 0.08 per cent distortion and 20 watts for 0.2 per cent. For 15 watts output the input required from a microphone is 3mV, from a gramophone pickup, 6 to 8mV, and from radio, 40mV. An attractive feature is the translucent illuminated control panel.

For public address work and for use in hospitals and schools, G.E.C. have developed an "industrial" radio receiver/amplifier with an output of 15 watts. Connections are provided for microphone or gramophone and separate tone controls are included. There is a tuning indicator and a built-in 3½in monitoring loudspeaker. Another new G.E.C. product is an inexpensive 8-10 watt amplifier capable of giving full output from a ribbon microphone and with a fader control for microphone and radio or gramophone inputs.



Rogers R.D. Senior amplifier and control unit.



N.S.R. 15-watt quality amplifier.

Quad II quality control unit.

Trix T635 amplifier for mains or battery.

Four KT66 valves in Class AB1 parallel push-pull give a rated output of 100 watts in the Grampian 531A combined amplifier and pre-amplifier. There are two 15Ω microphone inputs, one 0.25MΩ gramophone and one 0.22MΩ radio input. The Grampian Type MS12 portable a.c./d.c. amplifier is also new. It gives 12 watts for 2 per cent distortion and has inputs for a moving-coil microphone and a magnetic type pickup. The weight is 13lb.

N.S.R. Manufacturing, Ltd., have introduced a 15-watt quality amplifier which is based on many years' experience of p.a. installation work. Compactness and reliability have been given priority and the controls and inputs have been reduced to the minimum essentials.

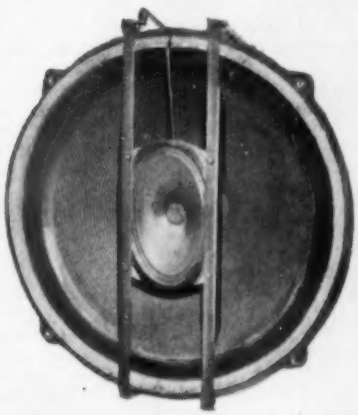
Neat workmanship and ready accessibility to components under the chassis are noteworthy features of the Trix T635 amplifier, which has been given a specification which meets the requirements of the majority of sound reinforcement systems. Normally it runs from a.c. mains and gives 30 watts output, but it can also be run from a 6-volt converter unit, when the power output available is 22 watts. The Trix T621 is a 25 (21) watt mains or battery operated amplifier with a somewhat simpler specification.

Loudspeakers.—Rather more activity than usual was evident among loudspeaker manufacturers represented at this year's exhibitions. Plessey have introduced a high-quality reproducer consisting of a 15in low-frequency unit combined with an elliptical h.f. unit mounted coaxially on a bridge across the main cone—with the major axis vertical to give wide-angle distribution of high frequencies in a horizontal plane. This particular speaker will be sold through Amplion (1932), Ltd.

The cambric cone introduced by Whiteley Electrical Radio has proved so successful that it has been decided to fit it in their 10in and 12in concentric duplex speakers, as well as in many other units in the range. A new horn-loaded "tweeter" unit rated at 15 watts, is now available for use in conjunction with W.B., 12, 15 and 18in and similar moving-coil diaphragm types.

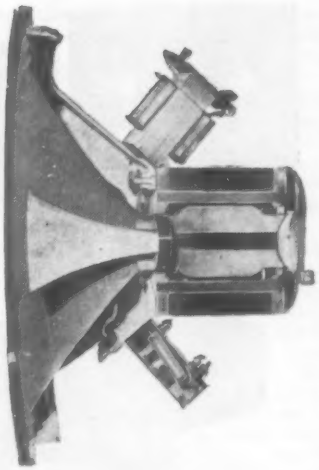
The Körting electrostatic tweeter (described in the March issue, p. 148) is now being supplied by C. T. Chapman (Reproducers). Also working on the electrostatic principle is the Type ES1 tweeter recently introduced by Grundig (Great Britain). It is designed for frequencies above 5,000 c/s, and for inputs up to 50V (a.c.) with a polarizing voltage of 250.

A horn-loaded twin-diaphragm moving coil unit

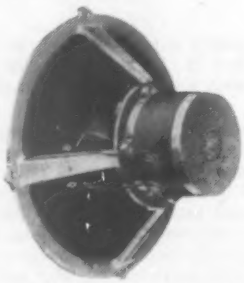


Plessey 15-in dual high-quality loudspeaker.

Rola-Celestion rear-protected car radio loudspeaker and (right) Grundig ES1 electrostatic loudspeaker.



Right: Sectional model of 12-in W.B. concentric duplex loudspeaker with cambric cone.



Elac 4in × 7in elliptical loudspeaker and (right) Wharfedale 12-in Type 12/CS/AL loudspeaker.

(PM3) with a 21-kilogauss flux density forms the basis of the latest Lowther corner reproducer (Type TP1). There is no electrical cross-over unit and a smooth transition between the loading of the horns at front and back of the diaphragm is effected acoustically by the design of the rear throat chamber. No bass resonance device is used.

Wharfedale, in addition to their three-speaker corner cabinet reproducer, were demonstrating a versatile single unit Type 12/CS/AL with a wide frequency range and good power-handling capacity. It is fitted with an aluminium voice coil and a cloth surround provides an effective termination for the edge of the diaphragm. The flux density of the magnet is 17 kilogauss.

A new high-quality loudspeaker, the "Victor," has been introduced by Pamphonic Reproducers. It combines a 15in unit with a 16-kilogauss magnet, operating in a vented chamber, with an elliptical high-frequency unit mounted to give wide-angle diffusion.

Many manufacturers are now producing small elliptical loudspeakers for television sets and car radios where space is restricted. Rola Celestion have a circular-diaphragm car-radio speaker with a protected back to minimize the possibility of accidental finger damage during installation or servicing. This combine was also showing an attractive range of shallow miniature moving-coil loudspeakers ranging from 2½ to 5in diameter. The 2½in unit has a depth of only 1¼in.

A new "pressure" driving unit (DC30, rated at 30 watts, has been developed by Truvox for use in conjunction with their exponential horns. Six units are combined in the LH100 projector loudspeaker which will handle 120 watts over a frequency of 125-7,000 c/s.

In addition to the omni-directional sound diffuser (DC/77) Goodmans Industries now make a smaller version (CD/66) with an overall diameter of 12 in and a 6in unit rated at 6 watts peak.

Richard Allan, hitherto known for their cabinet extension loudspeakers, have now entered the set manufacturers loudspeaker market with 5-in (6,000 line) and 10-in (8,000 and 10,000 line) dustproof and tropicalized units.

Tape Recorders.—In the Grundig TK9 recorder, which is smaller and lighter than the 700L "Reporter," separate fixed heads are used for top and bottom half-tracks. The tape drive is reversible, and, in conjunction with switching of the heads, enables both tracks to be fully recorded without changing over the spools. With 850-ft of tape the playing time at 3¾ in/sec is 90 minutes with one break. An automatic brake stops the tape at the end of each track.

The professional magnetic recording equipment made by Leevers-Rich, and used by many of the leading film companies, can be obtained for a.c. mains operation as well as for use with batteries, and the Model D will accommodate spools of the N.A.B. or European standard types up to 11½in in diameter. Detail improvements have been made in the amplifier layout, and the chassis can be hinged forward to give more ready access to the underside. There is a separate monitoring head, amplifier and loudspeaker, and in the Type A21B unit a built-in 1 kc/s oscillator and level meter are included for routine checking of optimum bias, amplifier gain and signal/noise ratio.

The tape mechanism used in M.S.S. recorders is now available separately as a unit (Model X). In addition to the normal functions of recording, replay, fast forward and fast rewind, the control knob has a fifth "cueing" position which simultaneously energizes the wind and re-wind motors to hold the tape at any predetermined place. M.S.S. are now producing their own tape and are paying special attention to the production of a highly finished working surface, for low background noise and reduced wear on the heads.

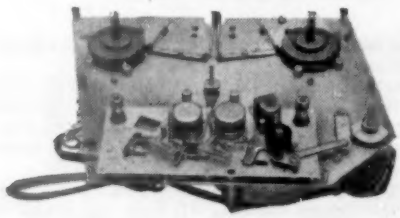
A new 7-in plastic tape spool for "Scotch Boy" tape has been introduced by Minnesota Mining and Manufacturing Co., with a 2¼-in hub for quicker re-winding and with improved tape anchorage slots.

The "gear lever"-controlled tape mechanism used in the Simon Model SP/1 portable recorder is now available as a separate unit. An interesting detail is the use of parallel-action push rods for actuating the tape pressure pads.

The design of the "Soundmirror" (Thermionic Products Model TP445), has been extensively revised and now includes twin tracks and alternative tape speeds of 3¾ and 7½ in/sec. A separate mixer unit for two microphones, radio and crystal pickup is available. The new "Diplomat" office recording machine, like the earlier "Recordon" makes use of flexible magnetic coated discs. It is fitted with a built-in loudspeaker, but the microphone can also be used for low-level playback. Facilities are included for using the amplifier as part of an "intercom" system.

Wright and Weaire demonstrated the many forms in which their tape deck can be used for entertainment or research. A new version of the domestic model will be supplied with Noval valves and will be known as Model 2AN. The scientific and industrial Model YD has been completely redesigned in a more convenient and compact form and will be known as Model YD/BF/2.

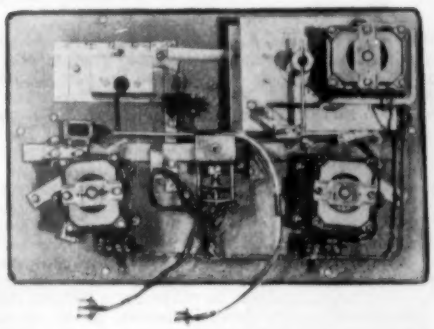
Truvox gave a comprehensive display of the many portable recorders making use of their Mark III tape deck, and were also showing a neat "radio jack" incorporating a two-station tuner unit and germanium rectifier, which, under favourable conditions, enables broadcast programmes to be received by any audio amplifier fitted with a standard Post Office type input jack.



M.S.S. Model X tape mechanism.

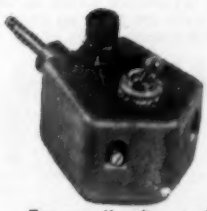
Thermionic Products "Diplomat" office recorder.

Wright and Weaire Type YD/BF/2 tape recorder.



Underside of Simon tape recorder unit.

Leevers-Rich Model D professional magnetic recorder.



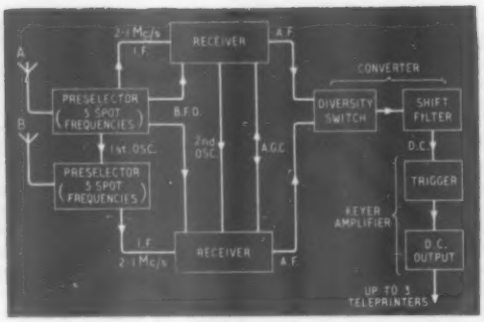
Truvox "radio ack" broadcast receiver.

Simplified Radio Teleprinter Terminal

A NEW frequency-shift, dual-diversity, receiving equipment (generally called a terminal) has been introduced by International Aeradio for operating teleprinters over radio-communication circuits where a certain amount of manual control is acceptable. It should fill the need for a relatively simple installation for receiving meterological radio reports, press radio broadcasts and for point-to-point radio traffic not wholly automatic in operation.

The normal Type "A" terminal can be operated by switch selection on any one of five pre-set crystal-controlled radio channels in the band 3 to 20 Mc/s. Based on the IAL/Plessey "Radprint" equipment, it consists of two double superheterodyne receivers working in diversity with the first, or pre-selector as it is called, giving an output on 2.1 Mc/s which is converted to 455 kc/s in the main receiver for amplification and demodulation.

The output from the two main receivers, which is in the form of an a.f. signal, is fed into an electronic diversity switch which selects the better of the two signals and completely rejects the weaker. The final amplifier gives an output sufficient to operate three teleprinters. A schematic drawing showing the arrangement of the main items of the equipment is reproduced here.



Schematic arrangement of the International Aeradio Type "A" dual-diversity teleprinter receiver.

A feature of the electronic switch is that the change-over from one receiver to the other is effected so quickly that the "mark" signal might be received on one and the "space" on the other without interruption or distortion of the printed message.

All the equipment is assembled in a modern 19-in rack-type cabinet standing 3 ft high and fitted with a hinged door at the front. The whole is fully tropicalized.

METAL FILM RESISTORS

OUR report of the R.E.C.M.F. Exhibition (May issue) may have given a somewhat misleading impression about metallic film resistors. A sharp distinction should have been drawn between the metallic oxide type, like those that were shown by the Ministry of Supply, and the true metallic film.

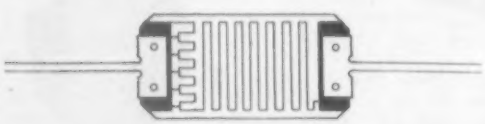
On the face of it, the metallic film offers many attractions, especially in the matter of stability and low noise. Resistors consisting of metallic films deposited on glass rods were in fact made commercially in the 1920s, but the technique then in use did not lend itself to the production of high ohmic values. A new method, described in British Patent No. 689,795, is used by Painton and Company in the manufacture, under the trade name of "Metlohm," of true metallic film resistors in values up to 400,000 ohms.

The manufacturing process consists, briefly, in coating a glass base with an extremely thin layer of a platinum-gold solution, firing to bond the metal firmly to the glass and burn away the unwanted ingredients in the solution, and then scribe the coated surface by a photo-etching process to produce a long, thin ribbon-like track.

The actual elements are cut from the parent sheet and for the $\frac{1}{4}$-watt range (MF104) measure $1\text{ in} \times \frac{1}{2}\text{ in} \times \frac{1}{16}\text{ in}$. A typical element, fitted with end-connecting wires, has the appearance shown in the drawing. For protection the resistors are given an overall coating of Silicone lacquer.

Resistance values range from 25 to 400,000 ohms with tolerances of 1% to 2% and a positive temperature coefficient of 0.025% to 0.027% per deg C. Over the normal audio range the noise level is said to be better than 0.05 μV per applied volt d.c. The shelf-life is good as after 12 months' storage the resistance change is less than 0.2%.

An $\frac{1}{4}$-watt range (MF103) with resistance elements measuring $\frac{1}{2}\text{ in} \times \frac{1}{4}\text{ in} \times \frac{1}{32}\text{ in}$ only is in course of preparation.



A typical etched pattern used on the new metal film resistors made by Painton.

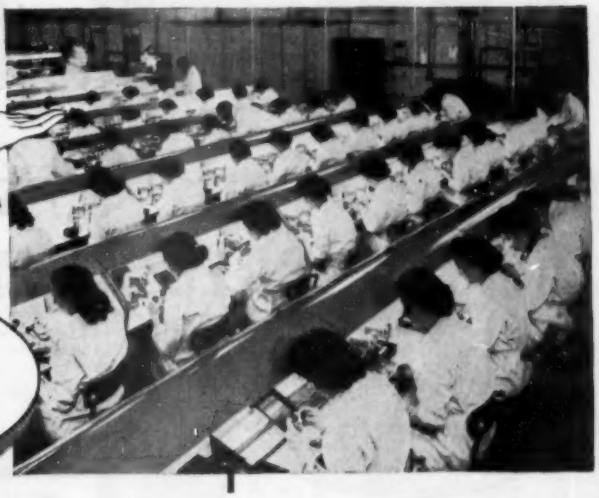
Public Address Quality

THE Association of Public Address Engineers held its fifth annual luncheon and exhibition in London recently, at which the principal speakers were A. E. Mason of the B.B.C., L. W. Murkham, the president, and A. E. Buchan, the immediate past president. Mr. Buchan paid tribute to the standards of quality established by the B.B.C. over the past 25 years, and drew attention to the increasing public appreciation of high quality of reproduction in sound reinforcing systems. In his opinion the time had come for the establishment of standards of quality among responsible p.a. engineers; those who ignored this trend would find themselves left by the wayside. Mr. Murkham entered a strong plea for more active participation by users of p.a. equipment in the work of the Association, which had so far fallen principally on the manufacturer and founder members.

The exhibition, which was well attended, showed the products of seventeen firms, and details of some of the items of interest are included in the report on another page of this issue. Demonstrations of equipment were a much-appreciated feature of the exhibition.

After the luncheon, the annual general meeting was held, at which J. F. Doust was elected president for the coming year.

We see to it...



BRIMAR VALVES

are more reliable than EVER!

Rigid control of production processes, a ready acceptance of improved manufacturing techniques, and continual vigilance in the analysis and selection of raw materials ensure that every BRIMAR valve will do its job more efficiently . . . more reliably.

Modern manufacturing methods backed by an intensive research and development organisation enable BRIMAR to anticipate and meet the changing demands of the radio and electronic industries. There is bound to be a BRIMAR valve to exactly meet YOUR specification.

now is the time to ***BRIMARIZE!***

The 12AT7 is a very reliable frequency changer and is widely used in modern TV receivers, VHF and UHF communications equipment. It is also frequently employed in industrial equipment, computors, navigational aids and test equipment.

BRIMAR	MULLARD	MARCONI OSRAM	COSSOR EMITRON
12AT7	ECC81	B152 & B309	12AT7

Standard Telephones and Cables Limited

FOOTSCRAY, KENT. FOOtscray 3333

Use the BRIMAR 12AT7 with improved performance at NO EXTRA COST

Another Fine ACOS CRYSTAL MICROPHONE...

Desk Stand or Hand

MIC 36 SERIES

MODEL Nos.

Microphone without switch and with table stand	MIC 36-3
Microphone with switch and table stand	MIC 36-4
Microphone without switch and with floor stand adaptor	MIC 36-5
Microphone with switch and floor stand adaptor	MIC 36-6

All models are suitable for hand use.

This new ACOS microphone has all the signs of being a "winner". It is a very handsome instrument —and its performance matches its looks. The die-cast microphone insert has a high sensitivity with a pick-up field that may be considered as omni-directional. Alternative models, with or without switch are available with suitable adaptors for floor or table stands.

SPECIFICATION

Output level: — 55 db. ref. 1 volt/dyne/cm².
Nominal capacity: '002mfd.
Omni-directional frequency response: Substantially flat from 30-7,000 c/s.
Recommended load resistance: Not less than 1 megohm dependent on the low frequency response required.

always well ahead

Retail Price in Gt. Britain	
Models without switch	£3-3
Models with switch	£3-8

ACOS devices are protected by patents, patent applications and registered designs in Great Britain and abroad.

GD **COSMOCORD LIMITED · ENFIELD · MIDDLESEX**

EUROPEAN TELEVISION

Some of the Engineering Problems in International Exchanges

By J. TREEBY DICKINSON*

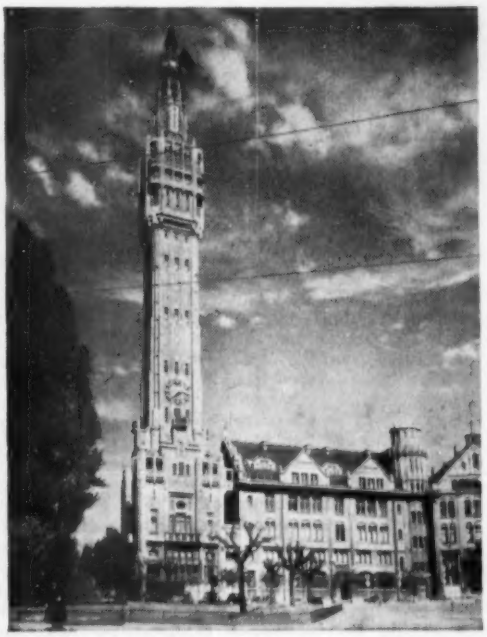
IT may be asked, what is the object of the present series of experimental television exchanges between eight countries organized by the European Broadcasting Union? First, to seek to determine, under reasonably representative operational conditions, the practical difficulties to be overcome, to establish a code of good engineering practice and to test draft specifications for the technical performances of the different kinds of links. It is also providing an opportunity for the concentrated training of operators and for enabling the officials responsible for programme production and presentation to obtain first-hand knowledge of the potentialities and limitations of the system.

There are, in effect, three phases in the development of a European television network. The first, the linking of countries by temporary and often transportable radio links provided by the television authorities and set up for each individual operation; the second, when permanent interconnections between neighbouring countries are provided by the telecommunications administrations of the countries concerned; and the third, when each country has adequate facilities for the transit of exchange programmes over circuits quite separate from those provided for distributing its own domestic television programmes.

At present the establishment of a single vision channel across Western Europe involves the temporary installation of a very large quantity of equipment, often in locations which are difficult of access, and this material has in general to be temporarily released from its normal assignments.

The planning engineers would have preferred to carry out these tests *in camera*, but the very high costs involved and the necessity of diverting staff and equipment from normal programme operations virtually made it essential to broadcast the programmes relayed, and, in general, they are being transmitted by all the eight participating countries.

The operation is probably unique in the field of broadcasting for the amount of international collaboration which went into its organization. It has involved not only the television engineers and programme officials from the broadcasting organizations of the eight countries but also engineers of the national telecommunications administrations who were required to provide extremely elaborate telephone facilities for carrying the sound components of the programmes, for the normal engineering control and for programme and engineering co-ordination purposes. One technical principle adopted was that, where a radio-link crosses an international frontier, the whole link, including both the transmitter and the receiver, should be the responsibility of one of the countries. Either the transmitter or the receiver would accordingly have to be installed and, in many cases, manned in a foreign country.



The paraboloid for the normal link with Paris can be seen at the top of the tower of the Lille town hall, which also houses the international co-ordination centres. The tower also carries the paraboloids for the links with Cassel (for London) and Flobecq (for Brussels).

There are, in effect, three television networks in Europe:—The B.B.C. network of nine stations, operating on 405 lines; the composite chain consisting of four 819-line stations in France, two 625-line stations in Holland and two in Belgium†; and the 625-line network comprising 16 transmitting stations in Germany, two in Switzerland, nine in Italy and one in Denmark.

The ultimate object is to have available technical facilities for relaying television programmes from any one of the countries to any other, but the object of the present series of exchanges is to determine the practicability of connecting up the existing national networks into a single entity, so that a television programme originating in any one of the countries could be radiated simultaneously in all the eight countries.

The problem in its simplest terms was to decide upon the most expedient means of interconnecting the countries and the most appropriate locations for

* European Broadcasting Union.

† The two Belgian stations use modified versions of the French 819-line system and of the so-called "European" 625-line system.

the equipment necessary for the conversion of the signals from one system to another. From the experience gained, it is hoped to prepare operating procedure and suitable performance specifications, applicable at any rate to the extremely heterogeneous circuits which will have to be used until permanent wide-band international interconnections are provided by the telephone administrations.

From the sketch map it will be seen that, in effect, England has to be connected to the Dutch-Belgian-French group and that group to the German network, which itself has to be connected in the north to Denmark and in the south to Switzerland and Italy. Moreover, each of these connections has to be two-way.

On the fifth floor of the campanile of the Town Hall at Lille, the Radiodiffusion-Télévision Française has temporarily converted its only large television studio in Lille into two International Co-ordination Centres, one for the programme and presentation aspects, the other for engineering matters. The Technical Co-ordination Centre is equipped with picture monitors for the three different standards, waveform monitors and the like, together with direct telephone circuits to the Technical Control Centres in each of the eight countries, with a direct teleprinter service for exchanging reports and other information.

As the equipment available was all extremely diverse in design and performance and as there was very little accumulated experience upon which to draw, it was necessary to prepare first of all a provisional performance specification for this operation. This would, it was hoped, be adequate to ensure the transmission of acceptable pictures, but would at the same time not be beyond the capabilities of the large number of different links in tandem. The main requirements decided upon (principally from B.B.C. recommendations) included:—

Video pass-band.—The upper frequency response should be such that the time of rise, measured at any point of handing over responsibility, for a square wavefront amplitude representing peak white, does not exceed 0.3 microseconds, counted from 10 per cent to 90 per cent of the final amplitude.

Random noise.—Should not exceed 50 per cent of the sync. pulse amplitude.

Hum.—Should not exceed 15 per cent of the sync. pulse amplitude.

Synchronization amplitude variation with picture content.—Variation should not exceed ±10 per cent of synchronization amplitude, between white and black pictures.

Suppression periods.—The post-synchronization suppression period should be at least 5 microseconds. The tilt should not exceed ±10 per cent synchronization amplitude.

Overshoot.—Should not exceed 20 per cent of synchronization amplitude.

Gradation.—Should be linear within 30 per cent, measured as the difference between the slope at any point on the reproduced saw-tooth signal, and the slope of the straight line joining its extremities.

Pattern interference.—Should not be worse than −40 db in the lower half of the video spectrum or −30 db in the upper half.

Picture black level.—There should be a difference of at least 5 per cent of the synchronization amplitude between the picture black level and the suppression level, to allow deformed sync. pulses to be removed completely without risk of mutilating the picture signals, where it is necessary to provide entirely new sync. pulses to render the signals suitable for onward transmission. To permit these parameters to be observed and measured with the minimum of difficulty, the following three standardized test signals were used (see diagram).

Test Signal A.—This is a flat-topped pulse of the full length of the line, repeating at line frequency. After remaining at full-white amplitude for a minute or two, it is slowly reduced to picture black-level, where it also remains a little while. It is used to show up any change of synchronization amplitude with varying picture content, and also to measure the overshoot noise and interference.

Test Signal B.—This consists of one or more narrow pulses of full-white amplitude. It is used to show up the time of rise, the overshoot and the difference between picture-black and suppression levels.

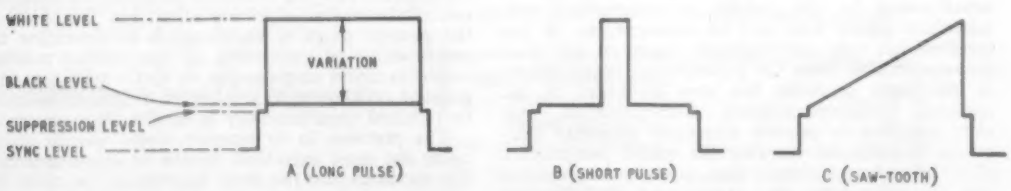
Test Signal C.—This is a saw-tooth of full-line length rising uniformly from picture black-level to full-white level and is used to indicate the linearity of gradation.

In addition to these signals, test patterns of various kinds incorporating gratings for assessing the transmitted definition are used, together, of course, with "live" camera shots and films.

The problems on the sound side are too various to be discussed here, especially as they are organizational and programme problems rather than engineering ones.

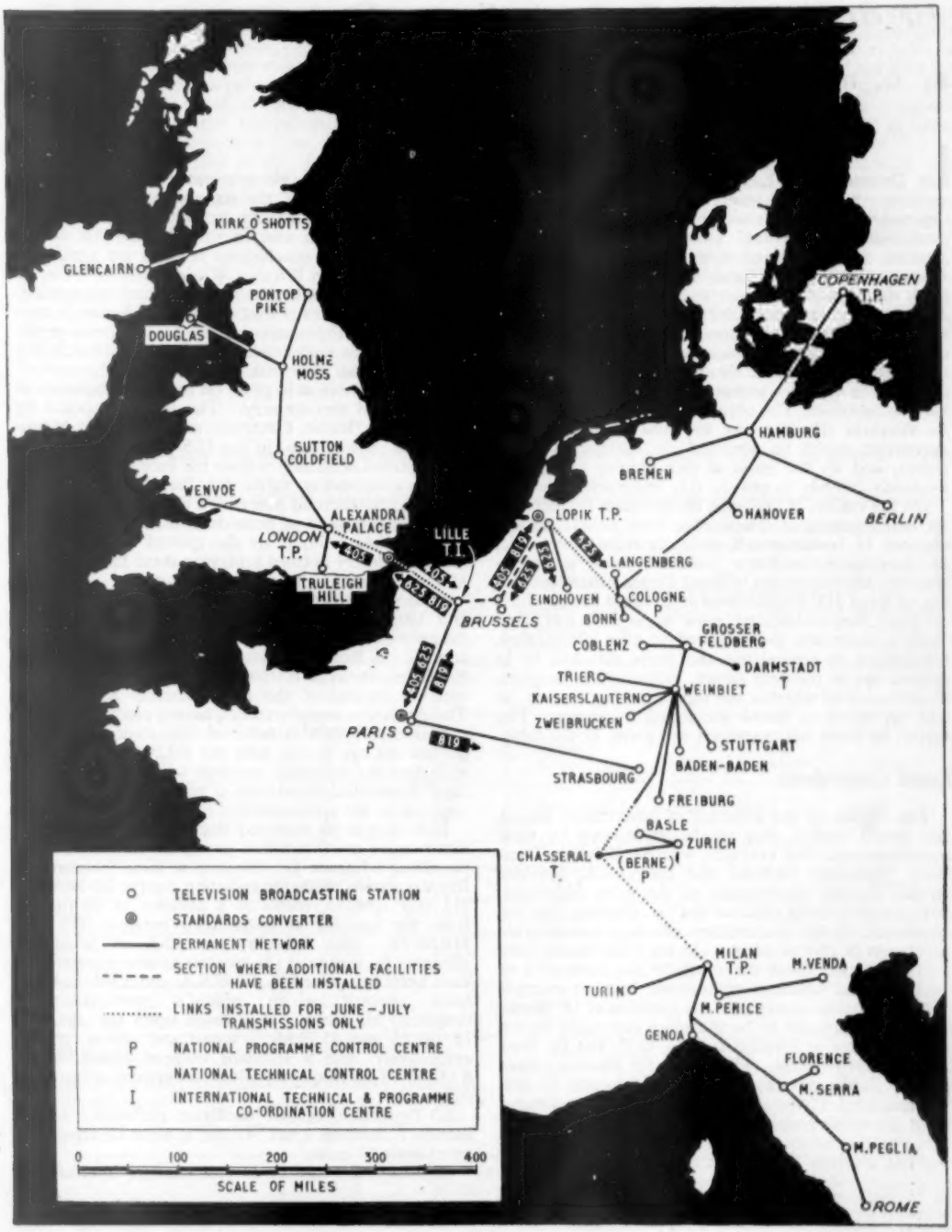
Few of the engineers were quite prepared for the very satisfactory pictures which were transmitted from Rome and Montreaux to all the other countries on 6th June, the day when the series of programmes opened, though there were temporary breakdowns. The last few minutes of the transmission from the Vatican were marred by picture jumping caused by surges on the supply mains at Milan, which was then experiencing a severe thunderstorm.

It is, at the time of writing, too early to make any prediction, but it seems justifiable to say that, apart



Standardized test signals used during the experiment. More than one short pulse (B) may occur during the line period.

from unreliability due to the absence of reserve equipment on the various links, the transmission problem appears soluble along the lines that we have adopted. The weak points are certainly the standards converters. The results that they are giving, however, justify the view that normal development will in due course enable results to be obtained of a quality acceptable to the great majority of viewers.



Television I.F. Inquiry

Aspects of Receiver Design in Various Countries

By G. H. RUSSELL, Assoc.Brit.I.R.E.

IN December, 1952, a questionnaire on television receiver problems was sent to manufacturers' organizations in a number of countries by the European Broadcasting Union's technical centre. Replies were received from Belgium, Denmark, France, Germany, Holland, Italy, Sweden, Switzerland, the United Kingdom and the United States of America at various dates during 1953 and 1954. These replies are given in a document recently published by the E.B.U.* This report deals mainly with intermediate frequency problems but also includes some interesting information on other aspects of receiver design in the various countries. The object of the questionnaire was to ascertain whether any measure of international agreement could be obtained on specific technical points, and on the basis of this inquiry the E.B.U. evidently intends to pursue this admirable objective.

On the subject of choosing intermediate frequencies, six major causes of interference were listed: second channel, i.f. breakthrough, oscillator second harmonic, i.f. harmonics, oscillator radiation from a nearby receiver, and harmonics of Band I transmitters appearing on Band III. Respondents were asked to say which of these they considered most important, and why. Each country was also required to give intermediate frequencies in general use and those that will be in general use in the near future, indication to be given in each case of whether the oscillator frequency is, or will be, above or below the signal frequency. The replies to these last questions are given in the table.

Local Conditions

The replies on the question of interference are, as one would expect, very much conditioned by local considerations. For example, whereas Belgium, Denmark, Germany, Holland and the U.S.A. consider second channel interference as the most important, Italy places it about third on the list, claiming that the disposition of her transmitters effects a considerable alleviation of this problem. On the other hand, Italy is very worried about the effects of the harmonics of the f.m. sound broadcasting stations. Another example of local thinking occurs over the question of i.f. breakthrough, considered to be the most important source of interference in Sweden and the U.K. but the least important in Holland. The reason for Sweden's fears is that public-services transmitters operate in the recommended i.f. bands. France is very pessimistic about the whole problem of interference, stating, quite correctly, that no i.f. will give complete immunity and that the solution lies in that elusive talisman, international agreement. No opinions are expressed on the relative importance of the six sources of interference listed. There is a private contribution to the document from Britain and in this the analysis of the problem and the conclusions reached are similar to those published in *Wireless World* recently.* One of the more surprising results obtained from an examination of the answers is that oscillator radiation is considered of so little importance. No one, except the U.K., places it higher than fourth in importance, the majority rating it as fifth or sixth.

Some information is given on oscillator radiation in America and this country. The limits proposed by R.E.T.M.A. (Radio, Electronic and Television Manufacturers' Association) in the U.S.A. are 50μV/metre at a distance of 30 metres from the receiver for Band I. The corresponding figure for Band III is 150μV/metre. Elsewhere in America, a figure of 15μV/metre has been proposed as both desirable and practicable. The B.R.E.M.A. limits are also quoted. To show how far the industry is from achieving these limits, results of measurements of receivers are given. Receivers measured in America at various periods in 1950, 1952 and 1953 gave between 63 and 762μV/metre at a distance of 30 metres from the receivers on Bands II and III. A British receiver is quoted as having given 890μV/metre at a distance of 10 metres from the receiver instead of the recommended 20μV/metre. The American manufacturers, having placed oscillator radiation as fourth in order of importance, evidently do not see eye to eye with the F.C.C., as that body considers the radiation problem so serious that they have threatened legislation if manufacturers do not conform to the recommended limits.

It is only to be expected that at u.h.f. all forms of interference are intensified owing to the difficulty of providing adequate pre-selection at these frequencies. Representative oscillator radiation figures lie between 512 and 2,840 μV/metre at a distance of 30 metres from the receiver at frequencies between 375 and 810 Mc/s. The difficulties at u.h.f. of providing adequate protection at the receiver against interference have been recognized in the U.S.A. and a solution has been adopted which provides protection by frequency allocation. It is based upon the standard i.f. (41.25 and 45.75 Mc/s sound and vision carriers respectively) and a standard channel separation of 6 Mc/s. This frequency allocation system operates as follows:

(a) Protection against oscillator radiation: transmitters 7 channels apart (42 Mc/s) must be separated by at least 60 miles.

(b) Protection against second channel interference

* Document Tech. 3062. "Enquête de l'U.E.R. sur le choix des fréquences intermédiaires dans les récepteurs de télévision (et questions connexes)." Not available to the general public.

* "Two-band Television Receivers," by G. H. Russell, April, 1954.

(sound and vision); transmitters 14 and 15 channels apart (84 and 90 Mc/s) must be separated by at least 60 and 75 miles respectively.

(c) Protection against i.f. beat interference: transmitters 8 channels apart (48 Mc/s) must be separated by at least 20 miles.

(d) Protection against intermodulation interference: transmitters 6 channels apart (36 Mc/s) must be separated by at least 20 miles.

I.F. beat interference refers to a situation where two signals beat together to produce an interfering signal whose frequency is equal, or close to, that of the intermediate frequency. For the parameters chosen this can occur with transmitters 7 or 8 channels apart. The former was covered in (a). Intermodulation interference occurs when two signals beat together to produce an interfering signal whose frequency is equal or close to that of the signal being received.

Systems in Use

It may not be generally realized that five television systems exist in western Europe to-day. First of all there is our own 405-line system. Next comes the C.C.I.R. system, used by all the countries of western Europe which have television except Belgium, France and ourselves. This operates with 625 lines, negative picture modulation, f.m. sound, 5.5-Mc/s spacing between sound and vision carriers and 7-Mc/s channel width. Then there is the French system, operating with 819 lines, positive modulation, a.m. sound, 11.15-Mc/s spacing between sound and vision carriers and 14-Mc/s channel width. Lastly comes Belgium with two systems: a French service which operates with 819 lines and a Flemish service with 625 lines, both with positive modulation, a.m. sound, 5.5-Mc/s spacing between sound and vision carriers and 7-Mc/s channel width. A further complication lies in the fact that in the French system the relative positions of the sound and vision carriers are inverted as compared with the C.C.I.R. and Belgian systems.

This poses some rather pretty problems in the frontier regions of Europe and particularly in Belgium where, depending upon the geographical location, it is possible to receive alternative programmes from France, Germany or Holland. A demand for multi-standard receivers evidently exists in all these countries, but not in those which are separated from countries using other systems by long distance or by mountainous terrain. The provision of a multi-standard receiver may testify to man's ingenuity, if not to his good sense, but the reader can judge for himself. Here are some of the replies, summarized, which were received in answer to the part of the

Table of intermediate frequencies in current use and those that it is expected will be in general use in the near future.

Country	Intermediate Frequencies In Current Use			Future Intermediate Frequencies		
	Vision i.f. (Mc/s)	Sound i.f. (Mc/s)	Position of Osc. relative to Signal Frequency	Vision i.f. (Mc/s)	Sound i.f. (Mc/s)	Position of Osc. relative to Signal Frequency
Belgium	41.75 25.5	36.25 20	Above and below	—	—	—
Denmark	Below 25 41.75 39.75	 36.25 34.25	 Above Above	 39.75	 34.25	 Above
France	80 40 66 24	66 24 80 40	} Sound i.f. lower than vision i.f. } Sound i.f. higher than vision i.f.			
Germany	About 25	—	Above	38.9	33.4	Above
Holland	23.5	18	Above	38.9	33.4	Above
Italy	25.75 45.75	20.25 40.25	Above Above	 45.75	 40.25	 Above
Sweden	23.5 39.5	18 34	Above Above	 —	 —	 —
Switzerland	23.5 39.5	18 34	— —	 39.5	 34	 —
United Kingdom	12—13 16 34	— — —	Below Above Above	 —	 —	 —
U.S.A.	25.75—26.4 45.75	21.25—21.8 41.25	Above Above	 45.75	 41.25	 Above

questionnaire concerned with receiver design and performance.

Belgium.—Nine-channel receivers are being manufactured capable of operating on four systems. A 12-position tuner is fitted but only nine positions are actually used. The tuner is provided with a fine tuning control. The wavechange switch automatically selects the system appropriate to the station being received; e.g., for German stations the receiver is automatically switched to negative picture modulation and f.m. sound. Only the line frequency is controlled independently. This must be so because Belgian transmitters are arranged to work with either line frequency in the event of relayed programmes. It is not clear how the differences in bandwidth requirements between the French systems and the rest are brought about, but it is mentioned that one Belgian manufacturer fits an extra switch which varies the i.f. pass band from 5.5 to 11.15 Mc/s. Sensitivity is 10-15 μV for Band I and 20-50 μV for Band III. Input impedance is 75Ω.

Denmark.—In practice, there are no receivers available capable of receiving all the C.C.I.R. channels, but 50 per cent of Danish receivers are fitted with a turret tuner in which it is a fairly simple operation to insert coils corresponding to any of the channels. The majority of the other receivers in use are of the single-channel variety with space provided for a similar tuner. The insertion of new coils into an existing turret costs two to five per cent the initial cost of the receiver, and the fitting of a tuning unit 10 to 20 per cent. In either case it is necessary to return the receiver to the dealer or the manufacturer for the work to be carried out. It appears that the majority of customers prefer the single-channel receiver once they know that they can have the tuner fitted if required. One "straight" receiver was being made in Denmark in 1952: all others are superheterodynes with r.f. stages. The sensitivity of the single-channel receiver is 200-300 μV and the multi-channel 30-75 μV. Most aerials are of the two-element variety with 70-Ω coaxial feeder.

France.—As at present only a one-programme television network is visualized for the whole of France, French manufacturers consider that the most useful receiver would be single-channel with easily interchangeable coil-deck. If the customer moves to an area which is served by a different transmitter from that to which the receiver is tuned, the coil-deck can be changed in his home at an estimated cost of five per cent of the original cost of the receiver. Although it is possible that at some time in the future a second programme may be available, the public do not appear to be unduly worried about the prospect. For the frontier regions it has been suggested that a receiver similar to the Belgian might be an answer, but the matter is still under consideration. In the meantime, a receiver has been built for the Strasbourg region (where it is possible to receive German programmes) which employs two separate i.f. amplifier chains; one using 37.6 and 26.45 Mc/s for vision and sound, the other with 28.5 and 23 Mc/s. The inversion of the vision and sound carriers is presumably carried out by placing the oscillator above or below the carrier frequency. One or two r.f. stages are employed and a fine tuning control is provided on all receivers. Proposed sensitivities are, for Band III, better than 500μV for "standard" receivers and better than 50μV for "fringe" receivers (75Ω input impedance). These figures are quoted for 10V peak-to-peak output at the tube when the signal is 30 per cent sine-wave modulated. Sensitivity requirements for Band I have yet to be determined.

Germany.—All receivers except one are multi-channel. All employ an r.f. stage and a fine tuning control. The majority are switch tuned. Some receivers are made for Band III only, but can be converted to Band I if returned to the factory. No provision is made for other systems of transmission, and it is not made clear whether a demand for such receivers exists. Average sensitivity for 30db signal-to-noise ratio is 200-500μV. Input impedance is 240Ω. The standard aerial is a half-wave folded dipole with reflector and director.

Holland.—Receivers actually on the market are of two types: a four-channel version for Band I only and a 10-channel version for Bands I and III. All have a tuned r.f. stage, and continuous tuning is provided in conjunction with a turret switch. Sensitivity figures are given for "regional" and "sensitive" models as follows: 500 μV on Band I and 650 μV on Band III for the first, and 50 μV on Band I and 100 μV on Band III for the second. It is proposed to improve the sensitivity of the "sensitive" receiver in the future to 15 μV for Band I and 25 μV for Band III.

Italy.—Receivers being made in Italy operate on five channels between 61 and 216 Mc/s. It is possible that when the final disposition of Italian transmitters is known, single-channel receivers will be made on a limited scale for certain areas. Most receivers are superheterodynes with r.f. stage, switch tuning and fine oscillator tuning control. Sensitivity figures are quoted for 20 db signal-to-noise ratio and 20V peak-to-peak at the tube as follows: 150-200 μV for Band I and 250-350 μV for Band III. Input impedance is 300Ω. Nearly all receivers use the intercarrier-sound system.

Sweden.—As the Swedish television service is still experimental practically no receivers of Swedish manufacture exist. Imported models have a 10-channel tuner. This is another country for which only one programme is visualized. Nevertheless, it is felt that many receivers will require at least two channels, as it may be possible in certain areas to receive foreign programmes; e.g., in the south from Denmark. To combat oscillator radiation an r.f. amplifier is considered necessary, even on a simple receiver. It is expected that the following will be the sensitivity requirements. Single-channel receivers: 200 μV for Band I and 500 μV for Band III. Tunable receivers: 30-60 μV for Band I and 50-100 μV for Band III. These figures are for 3V output at the tube when the signal is modulated 30 per cent. Owing to the existence of large numbers of blocks of flats in the towns communal aerials will be largely used. It is intended to provide high-power transmitters for densely populated areas to permit the use of indoor aerials. Communal aerials erected on adjacent high ground are recommended for remote villages.

Switzerland.—The Swiss television service was still in the experimental stage when the replies to the questionnaire were sent. These are, therefore, rather in the nature of recommendations than an expression of fact or opinion. It is expected that single and multi-channel receivers will be in equal demand. Recommended aerials are similar to those in use in Germany, except that 60Ω unbalanced feeder is given as an alternative to 240Ω balanced.

U.S.A.—All v.h.f. receivers have 12-channel tuners. Most employ switched channels as this is the method of tuning preferred by Americans. During the first six months of 1953, 15 per cent of all receivers manufactured had a u.h.f. band. By the end of the year this type of receiver had reached 40 per cent of total production. Two methods of u.h.f. operation are in use. One uses a tuner which converts directly to the receiver i.f.; the other has a converter which turns the receiver into a double superheterodyne, one of the v.h.f. channels being used as the first i.f. A large number of receivers are being used with separate tuners or converters which cost between $10 and $50. Two methods of u.h.f. tuning are in use. One employs a turret switch with a fixed number of positions; the other is a continuous tuning system. With the turret switch method, channels can be changed by changing the coils—an operation that can be carried out in the customer's home without the use of a soldering iron. As there are 70 u.h.f. channels, continuous tuning systems are favoured by the manufacturer, if not by the customer. R.F. amplifiers are always used at v.h.f. but rarely at u.h.f. Most receivers have a sensitivity of 70 μV; the u.h.f. figure is a little higher than this. At this level noise is perceptible, but the picture is considered acceptable. The majority of the receivers are used with indoor aerials or with single-element dipole aerials mounted on the roof or in the attic. In fringe areas folded dipole aerials with reflectors mounted at a height of 50-100ft are usual.

The French reply also contains some interesting information on the aerial situation in that country. Until September, 1953, landlords had the right to oppose the erection of aerials on their premises and evidently used it, for on that date an edict was published decreeing that television and radio are, like the telephone, public services. As such, the landlord cannot (under certain conditions that have yet to be determined) object to the installation of an outdoor aerial. Nevertheless, this evidently does not solve the problem, as the French nation, being both practical and artistic, dislikes outdoor aerials, partly because of their cost and partly because of æsthetic considerations. Technical problems still to be solved are those relating to multi-channel, multi-directional aerials and communal outdoor aerials, which raise judicial and administrative problems as well. Some communal aerials already exist in Paris, but it is felt that television development in France will depend to a great extent on the ability of receivers to operate satisfactorily with indoor aerials.

On the question of whether any provision is being

made in receivers for the reception of colour television, all countries answered negatively except America and, surprisingly, Sweden. It appears that, as the start of a television service has been so long delayed in Sweden, it may well come about that monochrome and colour television will be introduced almost coincidentally. One of the modifications suggested is that the i.f. bandwidth be reduced by one megacycle to reduce the possibility of interference from the colour signal to monochrome receivers.

To the question of whether it would be possible to standardize the phase distortion in receivers so that a pre-correction could be made at the transmitter, answers ranged from a downright "no" from Belgium to an enthusiastic "yes" from Sweden. America considers it a possibility that such an arrangement might be introduced for colour television.

In the "conclusions" to the E.B.U. document, part of an editorial in *Télévision* by E. Aisberg is quoted: "A radio receiver can be used practically anywhere in the world. In revenge, a television receiver must be made, if not for each transmitter, at least for each country." When it is remembered that one more television system exists in eastern Europe, making a total of six for Europe alone, for the present, one can only add that television's revenge has been remarkably complete. The situation may yet be saved when Europe embarks upon Band IV and colour television, and we must surely all hope that the efforts of organizations such as the E.B.U. will be crowned with success when they attempt to obtain international agreement on these matters. Unfortunately, while all countries are in full support of international agreement, they are all very vague as to the method of attaining it. The situation is best summed up by Sweden's succinct observation that the possibility of such agreement "seems utopian."

In the meantime, perhaps the one redeeming feature of the present diversity of systems is that it possibly makes engineers' lives more interesting. In conclusion, one cannot help remarking that it is a great pity that the mainland of Europe did not adopt a certain well-tried system which uses 405 lines, positive modulation, a.m. sound, etc., etc. . . .

LETTERS TO THE EDITOR

The Editor does not necessarily endorse the opinions expressed by his correspondents

Transistor Symbols

WITH regard to letters in your March and April issues by F. Oakes and Henry Morgan on symbols for transistors, I enclose a copy of a DRTE/EL Memorandum* on the subject.

There is a small group at the Electronics Laboratory of the Canadian Defence Research Telecommunications Establishment, under N. F. Moody, which has been working on transistors for some time. We have adopted this convention for our own publications, particularly because it contributes to our understanding of the operation of circuits.

You will note that our convention has been developed from the electrical function of transistors rather than their mechanical form. Mr. Morgan's symbols represent the mechanical form of a diffused junction, or alloy transistor, and would not suggest a grown junction or surface barrier.

Since the enclosed memo. was written I have seen several other conventions used. Some of these use features of ours, and the trend seems to be towards one like we suggest.

I feel that the convention suggested in the memo. is a logical beginning from which symbols for new semi-conductor devices can grow.

Ottawa, Canada. P. M. THOMPSON.

[* The following is an extract of the relevant part of the memorandum.—ED.]

"*A Logical Convention Based on p-n Junctions.*

"It is well known that a junction rectifier or diode consists of a *p-n* junction, a junction transistor of two such junctions, and compound transistors of several. Also the impedance characteristics of the emitter of a junction transistor are those of a diode polarized in the forward direction, and the collector of a diode polarized in the reverse direction.

"There is an accepted symbol for a rectifier, as shown in Fig. 2 (a). It is suggested, therefore, that they should be drawn as combinations of these rectifiers. This leads to a convention for drawing transistors as shown in Fig. 2. The *p-n* junctions are shown as they are in the standard rectifier convention, and the emitters are shaded, or could be marked with a dot.

"A point transistor may be regarded functionally as a *p-n-p* transistor with $\alpha > 1$, and hence the base current flowing the opposite direction. It can also be considered as consisting of two point diodes.

"Diodes or rectifiers are commonly drawn either as shown in Fig. 2 (a) or in Fig. 3 (a). It is suggested that Fig. 2 (a) should represent a junction diode, while the

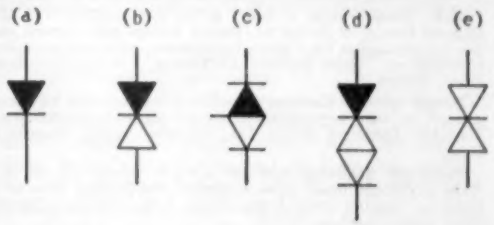


Fig. 2. A convention for junction transistors. (a) rectifier, (b) p-n-p transistor, (c) n-p-n transistor, (d) p-n-p-n compound transistor, (e) p-n-p symmetrical transistor.

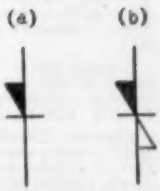


Fig. 3. A convention for point transistors. (a) rectifier. (b) transistor.

use of Fig. 3 (a) should be confined to point diodes. The above convention for junction transistors can be modified for point transistors as shown in Fig. 3."

British Colour Television

I THINK all engineers will agree that the Americans have earned the admiration of the technical world for the vast effort which has been put into their colour TV. And the result of all this effort has meant that a colour TV system has been evolved which can only be rivalled in complexity by those mysterious units installed in every automatic telephone exchange. In spite of this complexity, however, man's ingenuity has been stretched to a remarkable degree, and the system is capable of transmitting a colour picture from A to B. That is, of course, if one has unlimited financial resources and one or two skilled engineers are supplied with each receiver.

At some time in the future we must make a decision in this country as to the exact colour TV system which we shall inflict on our children and grandchildren. Without a doubt, once the receivers are sold we cannot change the system. It must therefore be a good system. With no colour service in operation the way must surely be obvious. The engineering profession and the various technical committees must not be subject to pressure from anywhere during these early colour TV decisions. They must not be panicked into thinking that any colour picture is better than none.

Here is a chance that will not occur again. The scanning standards must be reviewed. The u.h.f. bands must be considered. Due consideration must be given to the wonderful work done by the N.T.S.C., but this must not be allowed to affect our own approach to the problem. To make the system compatible may tie a weight round the necks of every receiver designer for the next century—so is it worth it?

The N.T.S.C. system has several disadvantages, all of which have been fairly stated in the published information. The one major handicap to my mind is that "it doesn't seem the way to do it." (I would hasten to add that I have no other workable solution!) In the past all major technical achievements have been finalized in a workable form in much the same way as had been predicted as a "dream solution" prior to the final realization. Dare we also anticipate the way to do colour TV? With one pick-up tube and the c.r.t. of the future that changes its colour according to a potential applied to an electrode (see "The Chromoscope." *Proceedings of the National Electronics Conference*, 1947, p. 549).

The engineer who works all day at his bench and who specializes in one branch or another may tend to lose sight of the larger goal which must be sought. Colour TV is desirable because at present there is something missing. That in itself is a challenge. That something may or may not be worth while, and indeed the colour picture will *not* be worth while if the resulting receiver is not a practical proposition. After all, surely that is what we must keep in mind. Whether we like it or not the real reason why anybody buys a TV set is to have a box in the corner that gives pleasure and entertainment to those who watch the screen.

Television, we are always being told, is a family affair. There is little doubt that all colour TV designers should remember this. Receivers at £250 to £300 will not sell—not even in America.

Carshalton, Surrey. CHARLES A. MARSHALL.

COMMERCIAL LITERATURE

Five-core Solder giving quick release of flux; brief technical details in the 2nd edition of "Modern Solders," an illustrated booklet from Multicore Solders, Hemel Hempstead, Herts.

H.T. Transformers; a leaflet giving specifications with the unusual feature of listing d.c. output voltage with current and the d.c. regulation for a given transformer, valve and capacitor combination. From Radford Electronics, 149 Newfoundland Road, Bristol 2.

Record Storage Cabinets in polished walnut, with top large enough to take a receiver or record player. Leaflet from Whiteley Electrical Radio Co., Victoria Street, Mansfield, Notts.

Miniature Soldering Iron for 2.5-6 V supply a.c. or d.c. With 4-V transformer (also available) the heating time is 6 seconds. Leaflet from Arthur Gray, Ltd., 150-152 Charing Cross Road, London, W.C.2.

Marine Broadcast Receiver (Cameo Senior, model RM215); a 5-valve superhet covering long, medium, trawler and short wavebands. Specification and descriptive leaflet from Rees Mace Marine, 11 Hinde Street, Manchester Square, London, W.1.

Vacuum Pumps (oil and mercury diffusion types), silicone pump fluids, leak detectors, ionization gauges and other vacuum equipment described in illustrated technical leaflets from W. Edwards & Co., Manor Royal, Crawley, Sussex.

Superhet Chassis with gramophone connection, bass and treble controls and push-pull output giving 8 watts. Specification on a leaflet from Tape Recorders (Electronics), 3 Fitzroy Street, London, W.1.

Automatic Mains Voltage Regulator, using motor-driven variable auto-transformer, with stabilization of within ±1% for input variation range of 50 V. Max. load current 22 amps. Illustrated leaflet from Airmec, High Wycombe, Bucks.

Digital Computor of plug-in unit construction with 550 valves, punched-tape input and typewriter output. The digit rate is 333,000 per second and the power consumption 6 kVA. Specification and brief description from Elliott Brothers (London), Century Works, London, S.E.13.

Anti-vibration Mounts for airborne equipment, with air damping and non-linear springs giving substantially constant natural frequency (8 c/s) with varying loads. Catalogues from Cementation (Muffelite), 39 Victoria Street, London, S.W.1.

Power Rheostats, toroidal wound, in five sizes from 25 to 150 watts and interchangeable with certain American types. Illustrated brochure of technical data from the British Electric Resistance Co., Queensway, Enfield, Middlesex.

Marine Radar Operation; a brochure on the Marconi "Radiolocator IV" giving a pictorial explanation of the controls to avoid frequent reference to the detailed instruction manual. From Marconi Marine, Marconi House, Chelmsford, Essex, price 4s.

Government Surplus Equipment; a new illustrated catalogue from A. T. Sallis, 93 North Road, Brighton, Sussex, price (including postage) 1s inland, or 2s 6d overseas by air mail.

Crystal Set, using germanium diode, mounted on standard two-pole telephone jack and intended to be plugged into any amplifier with a high-impedance microphone input. Selection of two preset-tuned m.w. stations by toggle switch. Leaflet from Truvox, 15 Lyon Road, Harrow, Middlesex.

"BELLING-LEE" NOTES

Band III Television Aerials

There is no problem in producing Band III aerials as such. With our associates overseas we have in fact made comparable aerials in considerable numbers. We were the first to show a production model at the Radio Show two years ago, incidentally the first Band III aerial to be shown at any British Radio Exhibition.

Before we feel that we can offer Band III aerials for sale, we must have certain confirmed details of the transmitters (1) siting (2) polarisation (3) power and (4) mast height.

Our development policy is quite clear: we have in fact made every type of aerial that will be required, but it would be wrong of us to guess what type of aerial to sell for use in any particular locality.

As the acknowledged leaders in technical development, our services are more and more called upon by the highest possible authorities in the country. We can assure everyone that we will make Band III aerials available in sufficient quantities and in plenty of time to meet requirements.

It would be very easy to sell Band III aerials for use in say, London, Birmingham and Manchester but we would be unable to give any assurance that we were selling the correct type.

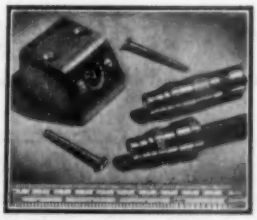
Designed for a purpose

In the March issue of the "Wireless World," we told readers of the varying results that were obtainable from aerials fairly close to each other. We showed how it was that a lower gain aerial could provide better results than a more sensitive aerial, due to standing waves. The result of these effects sometimes gave users the impression that there were better aerials than those manufactured by "Belling-Lee," but on investigation, almost invariably the alleged improvement was due, either to the faulty erection or to the bad siting of our product. Quite recently a most interesting case of this type came to our notice. We heard of a 3-element array with a folded dipole giving better results than a "Belling-Lee" "Junior Multirod." Now we knew this could not be, so we set out to investigate the matter. The situation was a bad one, on the wrong side of a hill and the results were very poor. The first thing we looked at was the connection to the matching transformer. The entire transformer had been removed and nobody would accept the responsibility for the missing part. When a transformer was connected as laid down in the instructions, up came the signal, very much better both on sound and vision than the other array. Admittedly the picture had a lot of grain, as the situation was a very bad one and the available signal was weak, but no better signal could be found with any other aerial.

We have mentioned the question of the matching unit before. If only people would read instructions; we can just see a not very technical rigger looking at a stub transformer, wondering what it is, and removing it. The only time you remove the built-in matching stub is when the aerial is being used with a mast head pre-amplifier. But we repeat, do read the instructions, if only to make sure that there has not been some modification since the last one you saw or used.

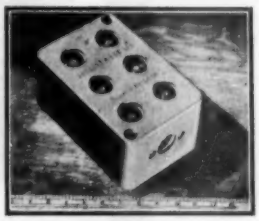
Advertisement of
BELLING & LEE LTD.
Great Cambridge Rd., Enfield, Middx.
Written 24th May, 1954.

COAXIAL OUTLET SOCKETS
for TV installations



L 735 OUTLET SOCKET BOX A new, improved single outlet box in an attractive bronze finish for neat termination at the skirting board. Accommodates $\frac{7}{16}$ in. dia. feeder. Designed for use with the range of plugs L734/P, L781, etc., and also the "Belling-Lee" line attenuator.

L 763 DOUBLE OUTLET SOCKET BOX Has two standard outlet sockets and a "star" matching network which provides the coupling. When two receivers are connected, the input to each is 6 dB down on the input to box. For demonstration rooms, workshops and laboratories, etc., or where neighbours wish to share an aerial installation.

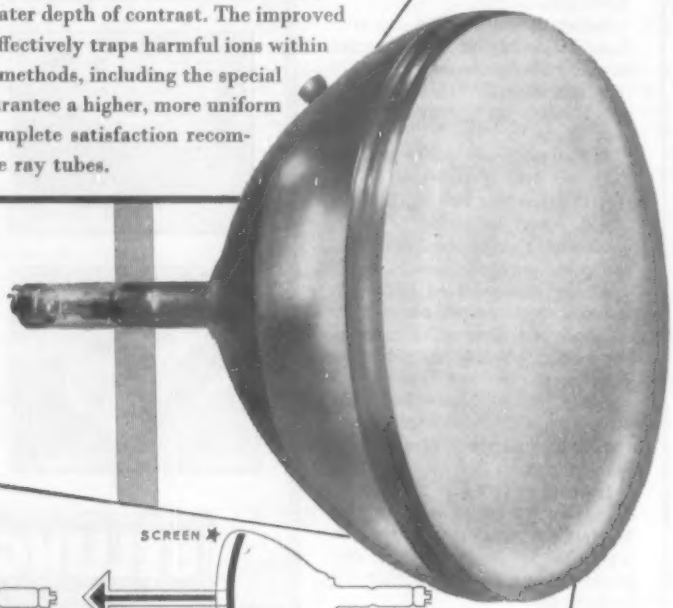


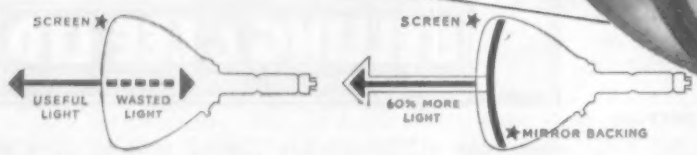
L 742 6-WAY DISTRIBUTION SOCKET BOX For use in demonstration rooms, workshops, etc., where up to six television receivers are required to operate at the same time without interaction. As the insertion loss at each outlet is considerable (25 dB), it should only be used where a high signal level is available.

BELLING & LEE LTD
GREAT CAMBRIDGE RD., ENFIELD, MIDDX., ENGLAND

Clearly—you get better pictures with this ALUMINIZED cathode ray tube

You cannot beat the new Ediswan Mazda Aluminized Cathode Ray Tubes for picture quality or length of life. Ediswan Aluminizing gives 60% brighter pictures with greater depth of contrast. The improved ion trap tetrode electron gun effectively traps harmful ions within the tube. Ediswan production methods, including the special in-line exhausting process, guarantee a higher, more uniform standard of efficiency. For complete satisfaction recommend Ediswan Mazda cathode ray tubes.





Without Aluminizing

Without Aluminizing, tubes waste half their light by backward reflection. To counteract this the brilliance must be increased which shortens tube life.

With Ediswan Aluminizing

Ediswan aluminized tubes have a mirror backing to the screen. All the light is thus thrown forward giving brighter, clearer pictures, and extra life.

Quicker Service

Ediswan are the only company to have 6 fully equipped cathode ray tube service Depots throughout Great Britain, thus providing better, quicker tube testing should the need arise. Also, 18 Ediswan District Offices carry stocks of tubes.

EDISWAN

MAZDA

ALUMINIZED CATHODE RAY TUBES

THE EDISON SWAN ELECTRIC COMPANY LIMITED

155 Charing Cross Road, London, W.C.2, and branches

Member of the A.E.I. Group of Companies

Vector Diagrams Again

"CATHODE RAY" Advocates a Less Confusing System

SOME while ago an Australian reader sought an explanation of the phase shift between primary and secondary in r.f. transformers, which, he said, seemed to be taken for granted in the books. It is quite an important point, especially in connection with f.m. receivers. And it could hardly be answered properly without vector diagrams. The question was: What kind of vector diagrams? A few years earlier I had tried to show that vector diagrams as commonly seen are unsatisfactory, and explained a modified type of diagram that had just been described in *Electrical Review* by M. G. Scroggie. But if now I adopted this type without warning it would probably find everyone in the state of having forgotten all about it, if indeed they had ever heard of it. On the other hand, could I go back to the bad old style?

While I was pondering this dilemma, more and better information on the revised diagram appeared in *Electrical Review**. One distinct improvement was a new current notation to balance the already familiar subscript notation for voltages. Seeing that my previous exposition of vector diagrams had been unlucky in attracting the activities of an exceptional number of hostile gremlins, this seems to be the time for a review. The transformer question can then come in nicely as an example.

* 1st, 15th and 22nd January, 1954.

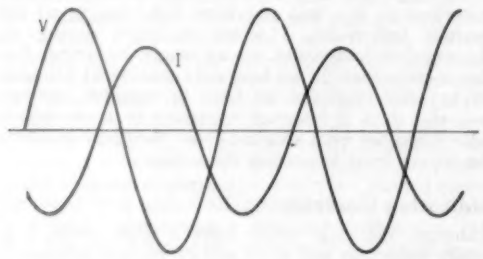


Fig. 1. Waveform presentation of alternating quantities.

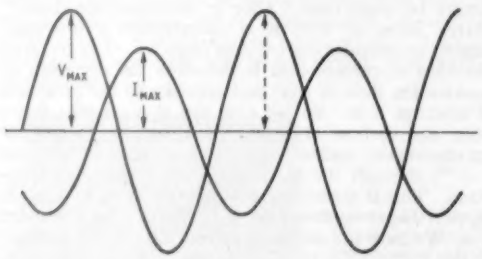
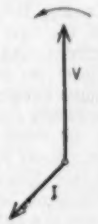


Fig. 2. In the Fig. 1 type of diagram, relative magnitudes are compared by noting the dimensions marked—the peak values—and phase by the distance between (in this example) I_{max} and V_{max} compared with one whole cycle.

The purpose of vector diagrams, of course, is to show the relative magnitudes and phases of alternating quantities, such as voltages and currents. One method of doing this is what might be called the oscillographic or waveform diagram, such as Fig. 1. Even with only two quantities, as here, it is quite troublesome to draw clearly, and with eight or nine is just a mess. Most of the effort goes in depicting the waveform, and instead of making the relative magnitudes and phases clearer it obscures them. To compare magnitudes one has to visualize dimensional lines joining the peaks of the waves with the base line, at right-angles, as in Fig. 2. The relative phase is judged by comparing the distance between the V_{max} and I_{max} lines with one whole cycle—the distance between two successive V_{max} lines.

But when, as fortunately is so often the case, all the waveforms are the same—sinusoidal—there is no need to waste time drawing them; only the peak dimensional lines need be shown. That being so, they can be rearranged to show phases more clearly, the standard method being to set them at different angles, as in Fig. 3, a whole cycle being represented by a complete turn of 360°. This scheme has the advantage, too, that as the whole diagram is supposed to be rotating anti-clockwise at one rev. per cycle the instantaneous values of all the quantities shown are represented continuously by the vertical heights of the points of the vectors above the centre of rotation. When a point is below the centre, its height is of course negative. Thus in Fig. 3 V is at its positive maximum, and the instantaneous value of I (if it is, as it looks, 135° ahead of V) is $-I_{max}/\sqrt{2}$. Still another—and very considerable—advantage of the vector form of diagram is the ease of adding and subtracting magnitudes in different phase.



Right: Fig. 3. When the waveforms are all the same and known, it is a waste of time drawing them, and all one needs are the peak dimension lines, which can be arranged to show phase much more clearly as angle. (Quarter of a cycle is much more easily recognized as a right angle than as quarter of the distance along a line.)

Circuit and Vector Relationship

A vector diagram by itself is not much good, however; one would not know what the "V," "I," etc., stood for. They are voltages and currents in a circuit, so one should have a circuit diagram on which these things are marked. Now, this is where the trouble begins. The diagrams of even the most reputable and

eminent authorities often fail to provide an unmistakably clear tie-up between circuit diagram and vector diagram. The first book I looked at, written by the Principal of a technical college, was wholly devoted to electrical vector diagrams. As it was about 20 years old, however, I next looked up one of the most recent works by a progressive Professor of Electrical Engineering. Both these books agreed in marking voltages between points in circuits by two-way arrows as in Fig. 4(a). (The reference letters to mark the points are my own.) This scheme does at least show the points between which the voltages exist, and it does suggest that the voltage is alternating. But that is the utmost that can be said in its favour. Suppose the corresponding parts of the vector diagram were as in Fig. 4(b). This tells us that V_2 is exactly opposite in phase to V_1. But when we try to apply this information to the circuit diagram we find two possible and exactly opposite interpretations. It is like the man who, when asked if Oxford or Cambridge would win the boat race, replied "Yes!" When point *b* is maximum positive with respect to *a*, we can be sure that either *c* or *d* is maximum negative with respect to the other. It looks as if we shall have to toss for it, and have a fifty-fifty chance of being right. To so-called sportsmen that may be magnificent but it is not electrical engineering. The learned authors might perhaps reply that if we were to study the rest of the circuit and apply fundamental principles we ought to be able to work out the correct answer. But surely, gentlemen, that is not good enough! These diagrams are intended to save our brains, not to give them needless mysteries to solve!

Oddly enough, both these eminent authors marked *currents* in the circuit by one-way arrows, so their two-way voltage arrows are not even a consistent policy. Manchester has a reputation for ideas, and turning there I found an instructional publication for teachers of electrical engineering, in which both currents and voltages are marked with one-way arrows. These do not quite so clearly indicate exactly the points between which voltages are reckoned, and might be rather confusing in circuits where d.c. also existed. If we were really critical we might also think it a little queer to mark alternating quantities as if they went in one direction only. But these are perhaps carping criticisms, and we ought to be thankful to find that there are authorities who advocate a system that does not leave one guessing. If Fig. 5 was their version of Fig. 4(a), then Fig. 4(b) would unmistakably mean that when *b* was maximum positive to *a*, *c* would be maximum negative to *d*, and so on around the cycle.

Other authorities, though strangely few in this country, label the points of the circuit with letters, as I have done. Then instead of having to use an arbitrary number to distinguish one V from another, the natural and obvious thing is to use letters—V_{ab}, V_{cd}, etc.—which not only distinguish the voltages but also show definitely the points between which they exist and the relative directions in which they act. So this system combines the best features of the other two, and adds some that they lack. Using it, there is no need to mark the circuit diagram with any voltage labels or arrows; only to letter the points concerned. The vector diagram Fig. 6 provides the information of Figs. 4(b) and 5 combined. Obviously V_{dc} is the same thing as $-V_{cd}$, so the same information would be given by a diagram consisting of two vectors, V_{ab} and V_{cd} pointing in the *same* direction.

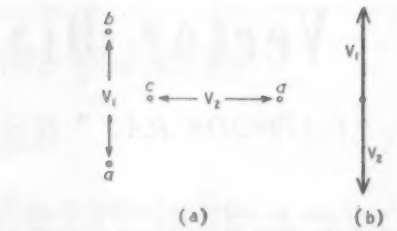


Fig. 4. (a) is a common method of marking voltages between two circuit points, in relation to a vector diagram (b), but, it is ambiguous.

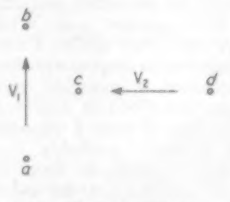


Fig. 5. This alternative to Fig. 4(a) removes the ambiguity, but suggests that the voltages are unidirectional, and is quite unnecessary.

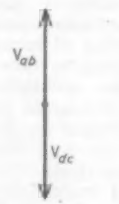


Fig. 6. This alternative to Fig. 4(b) identifies the voltages on the circuit diagram unambiguously without any arrows at all.

Notice particularly that all this works quite smoothly without our having to decide whether positive V_{ab} means *a* more positive than *b* or *b* more positive than *a*. If the meaning is reversed, it is reversed for all the voltages in the diagram, and with a.c. that is all right. For if you and I were to give opposite meanings to V_{ab}, and you were right during all the positive half-cycles, I would be right during all the negative half-cycles, so we would be quits! But this is because so far we have only considered voltages. In any real problems we have to consider currents too, and then it becomes necessary to know which convention has been adopted about the order in which the letters come in naming the voltages.

Indicating Currents

Although this may seem quite a small point, it is vitally important and there will be endless misunderstanding if we don't get it clear now. Fig. 7 shows perhaps the simplest possible circuit—a source of e.m.f. driving current through resistance. Although it may be crazy (see "Alice in Solidconductorland," March issue, p. 152) it is nevertheless a universal custom to consider electrons as negative. The positive direction of current flow is therefore the direction of positive ion flow (if any) and opposite to the direction of electron flow. So we may say that current flows from the carbon electrode of a battery (which is conventionally called positive and marked red or "+") through the external circuit to the zinc electrode. This is shown by the arrow's head in Fig. 7. In this diagram, therefore, *b* is positive with respect to *a*. We have the choice of calling the positive voltage in this circuit V_{ba} or V_{ab}. If we called it V_{ba}, then this would mean $V_b - V_a$, or the voltage of the first-mentioned point with respect to that of the second. This is the "voltage-fall" convention, because whether one goes from *b* to *a* through the

battery or through the resistance (or through the surrounding space, for that matter) the potential is falling. If on the other hand we adopted the voltage-rise convention we would call the positive voltage V_{ab}, still meaning $V_b - V_a$, or the voltage change in the direction $a \rightarrow b$. (It is the principle of the thing that counts of course; if the top terminal had been labelled *a* the positive voltage according to the potential-rise convention would have been V_{ba}.)

So long as we make our choice clear at the start and stick to it, there is no excuse for misunderstanding. The majority of those who use a double-subscript-letter notation at all seem to favour the voltage-fall convention. So I only recommend the other because I am convinced that it is considerably better. Why is it? Look again at Fig. 7. The thing that is driving the current clockwise round this circuit is the e.m.f. of the battery. It seems reasonable to say that the direction of e.m.f. in a source is the direction in which the e.m.f. tends to drive current. In Fig. 7 the battery tends to drive positive current (and is succeeding in doing so) through itself from *a* to *b*, so I like to think that V_{ab} here is positive, not negative. Whatever we think, however, has to be in harmony with the principle that *the current flowing through a pure resistance is* (to use the a.c. term) *in phase with the applied e.m.f.* In Fig. 7 the current is flowing through the resistance from *b* to *a* and the applied e.m.f. (according to the voltage-rise convention) is V_{ab}. This is probably why so many people prefer the opposite convention. It admittedly comes easier to say "Oh yes; current from *b* to *a*, applied e.m.f. must be V_{ba}." But it is very much a matter of viewpoint. The source of the e.m.f. may be in quite another part of the circuit; there may be several sources, in fact. With the voltage-rise convention there is no need to worry about that; the whole of the rest of the circuit connected to the resistance being considered is in effect the source of the e.m.f. driving current through that resistance, and is acting through itself from *a* to *b*. If when considering a resistance one prefers to consider the voltage as acting through the resistance, then one's thinking can still be in harmony with the voltage-rise convention by regarding the resistance as a source of back voltage, V_{ab}, *opposite* to the direction of current; just as a box pushed across the floor is a source of pressure against the hand pushing it. Not everyone may take to this idea, but it is difficult to deny that inductance and capacitance in a circuit are sources of e.m.f. opposing the applied e.m.f.

If most people do prefer to think of the direction in which an e.m.f. acts as being the direction through the external circuit rather than through the source of the e.m.f., and there were no more to it, I would readily give in for the sake of uniformity. But there *is* more to it.

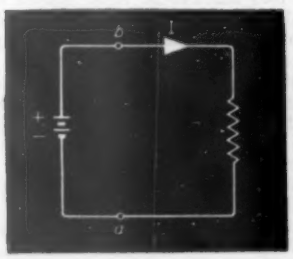


Fig. 7. Very simple circuit as a basis for discussion of circuit conventions.

Fig. 8. Provided that the circuit conventions are known, this is the simplest and clearest type of vector for the voltage between two units.

Fig. 9. The absence of arrow heads in the Fig. 8 type of vector obviates this kind of thing.

In Fig. 6 we have a vector V_{ab}. The same vector would represent V_{ba} if the label were changed and the arrow-head transferred to the other end. But electrical vectors invariably represent alternating quantities, which are constantly reversing, so it seems silly to pick on one of the two alternate directions rather than the other. It is altogether more logical to abolish both the label "V_{ab}" and the arrow-head, and simply to mark the ends of the vector line as in Fig. 8 to correspond with the points in the circuit. We British are supposed not to be logical, so that particular argument may not carry much weight; but as a practical race we ought to appreciate two things. One is that in a complicated diagram it is difficult to write in all the voltages so that no mistake can be made about which vectors they all belong to. The other is that when two or more arrow-headed lines meet, as in Fig. 9, it makes a mess. And if in order to avoid this the heads are put elsewhere on the lines there is risk of a confusion that I will mention a little later.

Seeing at a Glance

Fig. 8, then, is a neater (and more logical) job; but by far its most important advantage is still to come. It is, in fact, perhaps the outstanding advantage of the recommended type of vector diagrams. By marking all the voltage vectors in this way, we can see at a glance the instantaneous potential of every point in the circuit relative to every other point. Turning the diagram round clockwise, we can see how all these relative potentials vary as the cycle proceeds. With ordinary vector diagrams, this information has to be deduced laboriously, and unless one is exceptionally clever there are plenty of chances of going wrong. It is like the difference between seeing a working model and reading a specification of it—all the information may be in the specification, but it is difficult to visualize.

Before we go on to realize this by constructing a real vector diagram, we must just see how the idea of showing the vectors as in Fig. 8 affects our attitude to the potential-rise *versus* potential-fall question. One thing everybody will agree about is that in vector diagrams "up" means positive and "down" is negative. The natural meaning of the vector *ab* as shown in Fig. 8 is that point *b* in the circuit is maximum positive with respect to *a*. It is unthinkable that it should represent *b* as being negative to *a*. Now, we have already seen that this kind of vector is really two in one, for it is both upward and downward. If you wanted to refer to it in its upward sense, what would you call it? Surely *ab*! Again, it is unthinkable that *ab* in Fig. 8 could mean the downward sense. And a third unthinkable thing is that the vector *ab* should represent the voltage V_{ba}. Unless therefore our brains are topsy-turvy, we are bound to take *ab* in Fig. 8 to represent V_{ab} at its maximum positive value, *b* being positive with respect to *a*.

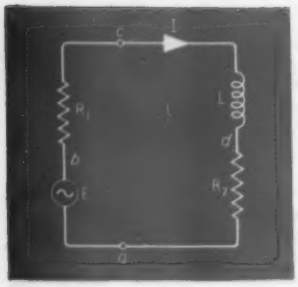


Fig. 10. Simple a.c. circuit as an example for comparing different types of voltage vector diagram.

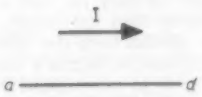


Fig. 11. First stages of a general vector diagram for Fig. 10.

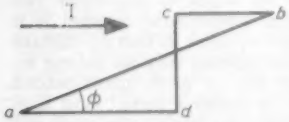


Fig. 12. A complete general vector diagram for Fig. 10.

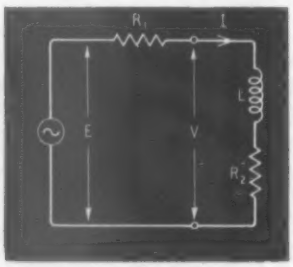


Fig. 13. How Fig. 10 would be drawn by some teachers.

In other words, we are bound to adopt the potential-rise convention. There is no way out that I can see!

Well, you may say, that is all very convincing and Q.E.D., but this new-fangled so-called vector is like the grand old Duke of York—neither up nor down; or, what is just as bad, both at once. If we had a pointing arrow we would know where we were! The answer is that only this two-way kind of vector suitably represents the undeniable fact that if *b* is positive with respect to *a*, *a* must at the same time be negative with respect to *b*. All the usual arrow-headed vectors, on the contrary, prejudice the case by picking out one of these two inseparable conditions. Not that this is necessarily wrong. There is often a good reason for picking one out rather than the other. If we were told that *a* in the circuit was earthed, then its potential would be fixed all the time at zero and it would be the potential of *b* that alternated. The natural way to represent this is to make *a* in the vector diagram the fixed point around which the whole diagram revolves. The usual method of showing this is to mark it with a dot or a small o. If you think this is not clear enough, then by all means mark the other end with an arrow-head. My point is this: until we *know* that *a* is earthed, and not *b*, or some other point altogether, it is not really right to assume that it is, by making all the vectors radiate from one particular point. And what about points *c* and *d*, when *a* is earthed? Since neither of these has any claim to priority, to mark the vector representing the voltage between them with an arrow at either one end or the other is arbitrary and meaningless, and may even be confusing. Everything in the perfect diagram has a logical meaning. The arrow-less vector, with the conventions I have just outlined, is so far as I know the only form that

(a) achieves a perfect tie-up between circuit and vector diagrams.

(b) is completely general, not assuming anything before it is known, and

(c) has one particular right form to represent a a given situation, and not a lot of confusing alternatives.

The best way of demonstrating these claims is to show some examples. We really ought to agree on a method of current notation first, but if we stopped to do that now we would come to the end of this month's allowance without a single real vector diagram, and that would be stretching patience too far. So just for now let us take an example with only a single current, shown in the usual way as in Fig. 7.

Fig. 10 is the circuit diagram. It represents a source of e.m.f. E with resistance R_1, feeding a load comprising inductance L and resistance R_2. In accordance with the recommended system the junctions have been lettered. Let us make sure that we have ready for use the basic phase relationships of a.c. circuits, for it is with these that vector diagrams are constructed:

(1) Current through resistance is in phase with applied e.m.f.

(2) Current through inductance lags applied e.m.f. by a quarter of a cycle (90°).

(3) Current through capacitance leads applied e.m.f. by 90°.

And remember that with the potential-rise convention the direction of the applied e.m.f. is regarded as the same as the direction of current *through the source of the e.m.f.*

The first thing to do when starting a vector diagram is to decide on a reference vector—i.e., one to which everything else can be related. In a simple series circuit like this, the current makes a good reference, because it is common to all parts of the circuit. The reference vector can be laid down in any direction we please, but it is usual to draw it at "3 o'clock," as in Fig. 11, that being the conventional zero of angular measure. If we had to construct the diagram to scale, in order to find, say, the actual magnitude and phase of current, given E, R_1, R_2 and L, then the I vector would usually be made unit length, representing 1 amp, and the diagram would in due course tell us the e.m.f. required for that current. Then it would be simple proportion: if that number of volts caused 1 amp, how many would E volts cause? Just now, however, let us draw an ordinary "qualitative" diagram, not bothering about particular numerical values.

At the moment we have no idea how the e.m.f. (V_{ab}) should be drawn, so we go on to something we do know, V_{ad}. That is the e.m.f. the rest of the circuit is applying to R_2 to make I flow through it from *d* to *a*. So we draw vector *ad* in the same direction as I (Fig. 11 again). Next comes V_{dc}, which is the e.m.f. applied to L, and must be 90° ahead of I if I is to be 90° behind it. So we draw *dc* accordingly, as in Fig. 12. Then *cb* in the same direction as *ad*.

Now *a* and *b* are located, so the relative direction (phase) and magnitude of the e.m.f. is revealed. Since *ad* is in the same direction as I, the angle marked ϕ is the angle the current in this circuit lags behind the e.m.f. If R_1 is the generator resistance, then the terminal voltage is V_{ac}, and Fig. 12 shows us that the current lags this more than it does the e.m.f. The point *b* is really fictitious, in the sense that it does not exist in the circuit represented by Fig. 10, for the e.m.f. is mixed up with R_1. But supposing now that R_1 did have a separate existence, Fig. 12 shows us without any effort the magnitude and phase of the voltage between *b* and *d*, in either direction.

Notice, too, the complete information about relative potentials. We see that at the chosen instant, when I is just passing through zero, *b* has recently started to be positive with respect to *a*. Point *d* is maximum negative to *c*, and so on. If you are not a novice, all this may be obvious without any vector diagram at all, or with only the usual sort. But that is because we have taken a very simple example; in problems that are worth making a vector diagram for in earnest it is very often far from obvious what all the relative potentials are. Note that Fig. 12 not only shows the potentials between any of the points marked, but likewise points unmarked; for example, one third of the way down R_2 from *d*. And it gives an instant answer to questions such as this: When the e.m.f. is at its positive peak, what is the potential of *c* relative to *a*? All one need do is turn Fig. 12 until *b* is vertically above *a*, and then note the vertical distance of *c* above *a*. The phase angle is also clearly shown.

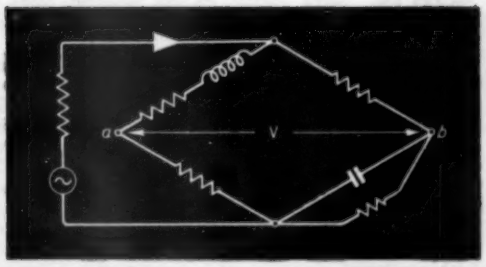


Fig. 15. Example of a circuit in which the ambiguity of the two-way arrow shows up.

Now let us end this month's instalment by comparing the usual kinds of vector diagram for Fig. 10 with Fig. 12. I am conscientiously going to follow the methods of eminent teachers. Their version of Fig. 10 would probably be something like Fig. 13. When it came to the vector diagram, however, there might well be considerable diversity. Fig. 14 (a) is a likely starter. It was commenced by drawing the I vector as before. The voltage drop in R_1 is of course R_1I, and is in phase with I. Invariably it would be drawn coinciding with the I vector. So would R_2I. This is where the confusion begins. Some authorities make every vector sprout from one point, while others sometimes put them head to tail. Unless one happens to know the idiosyncrasies of the particular author of the diagram, there is a possibility of misunderstanding when, as here, there are several vectors in the same line. For your information, I and R_1I here start from the same point, but R_2I begins where R_1I leaves off. Where R_2I leaves off, the voltage across L, which is $j\omega LI$, begins (the *j* merely being an instruction to turn it 90° clockwise). The line marked E clearly represents the voltage across all of them—the e.m.f. And the line V, being across the two load components, represents the terminal voltage V.

By now there is a nice mess of arrow-heads at the junction of the E and V vectors. If, to avoid this, the arrow-heads are drawn some way down the vectors, they might (in a less simple diagram) mislead one to suppose that they indicated part-way vectors like R_1I. It is, of course, standard practice to mix the current and voltage sectors up together, and often flux

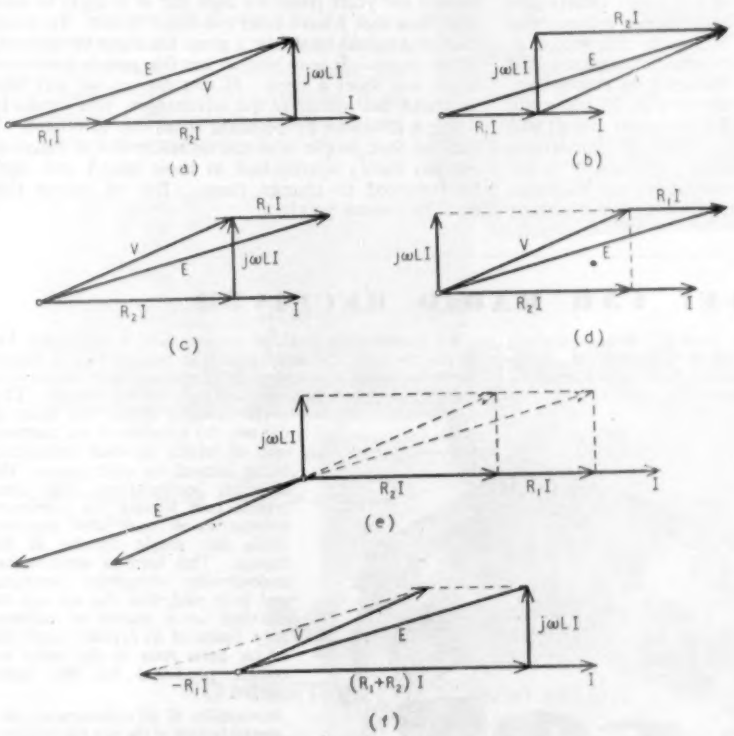


Fig. 14. Some of the many ways in which the vector diagram for Fig. 10 might be drawn, according to commonly taught methods.

vectors too. Some authorities use different types of arrow-heads to distinguish them, but not my learned mentors.

Altogether, then, one has to study this kind of diagram pretty closely to sort it out, even though this is such a simple example as to be almost trivial. And as for the information it supplies, one cannot even be certain, by looking at the vector diagram alone, which terminal is positive when the current is flowing as shown. In such a simple example it is easy enough to find out by looking at the circuit diagram, but if the circuit had been Fig. 15 would either the circuit diagram or a vector diagram drawn by the Fig. 14 method, or both combined, give a quick answer to the question: which is more positive, *a* or *b*? With the Fig. 12 type of diagram, all one has to do is to put the diagram so that the current vector is pointing upwards and then see which of the two points in question is higher than the other. It is surely a bad policy to use a system which, while it may not let one down on many occasions, is liable to do so on others, seeing that there is an alternative system that is reliable every time.

Look again at Fig. 14(a) and use it to find the answers to the questions we solved so easily with Fig. 12, and then ask yourself why people use the Fig. 14(a) type, and whether you are going to continue to use it in preference to Fig. 12. And remember that the more complicated the problem the greater the contrast between the two types. I would not say that the Fig. 12 type is the easier to construct at first, if you have been used to the other, but even at first it reveals its information more quickly and clearly and unmistakably. Of course there is no reason why $j\omega LI$ should not be written alongside the vector *dc* to save one having to look at the circuit diagram; and the same for any other notes that may be convenient.

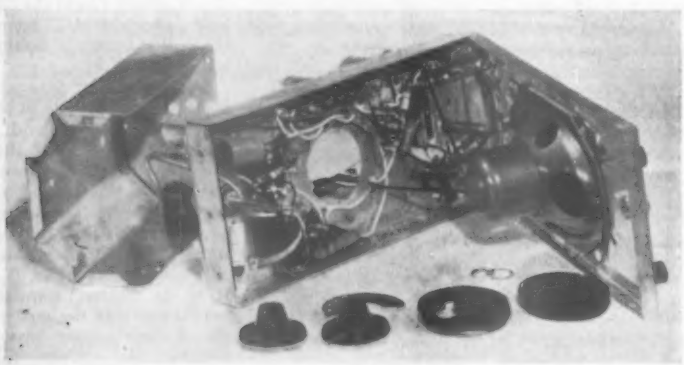
Lastly, there was the point about Fig. 12 being the one and only correct diagram for the given circuit and component values. That, I think, is important, because it must be very confusing for students to see a number of quite different-looking vector diagrams for identically the same circuit. Of course the current vector in Fig. 12 could be put elsewhere, so long as it was parallel to *cb*; and the diagram as a whole can be looked at from any angle. But it seems strong evidence of soundness in principle that no alternative shape can be arrived at, using the rules correctly. Contrast this with ordinary vector diagrams. Fig. 14(a) is a typical result, but we would have had an equal chance of full marks if we had drawn it in the other ways shown in Fig. 14. We might have taken the impedances in strict clockwise rotation, as at (b). Or we might have gone anti-clockwise, as at (c). Or we might have made R_2I and $j\omega LI$ sprout from the common centre and "completed the parallelogram" to find the resultant load, as at (d). Or we might have put the arrow-head at the other end of the vector R_1I, to show that V, the terminal voltage, is the resultant of E and R_1I, as not shown separately. Or, following another school of thought, we could have drawn the V and E vectors in the opposite direction, to show they opposed the impedances, as at (e). Or we might have shown the same thing rather differently, as at (f). And there are many other possible combinations; all correct according to the textbooks. In place of this multifarious confusion, would it not be better to adopt the simple and informative Fig. 12, where any variation or modification signifies some real change in the circuit; not merely a different person happening to be drawing the diagram?

Seeing, then, that what is called the general type of vector diagram has so many and manifest advantages over other kinds, why is it not in common use? It may be that although I have been deriving great benefit for years from my own use of it there is some fatal flaw that I have been too blind to see. In which case you would be doing a great kindness by pointing it out to me. It may be that too few people have seen it for too short a time. If you do *not* see any fatal flaw and can *not* deny the advantages, you would be doing a kindness by pointing them out to others. It may be that people who use or teach vector diagrams are too firmly entrenched in their habits and can't be bothered to change them. But of course that wouldn't mean you!

NOVEL CAR RADIO RECEIVER

THE illustration shows the special radio receiver designed by Pye and now being installed in every "Metropolitan" motor car made by the Austin Company for the Nash Corporation of America.

An unorthodox form of construction is employed, for, as can be seen, the loudspeaker is mounted on a hinged cover enclosing the underside of the receiver chassis with the magnet protruding through the receiver section. This cover actually forms the front of the set, the spindles of the controls, one of which is dual concentric, being located on each side of the elliptical loudspeaker. The concentric pair actuate the combined volume/on-off and tone controls, while the single spindle is for tuning. This form of construction undoubtedly simplifies servicing and it is said that the set can be installed in a matter of minutes only. Some of its features have not so far been seen in car radio receivers produced for the home market.

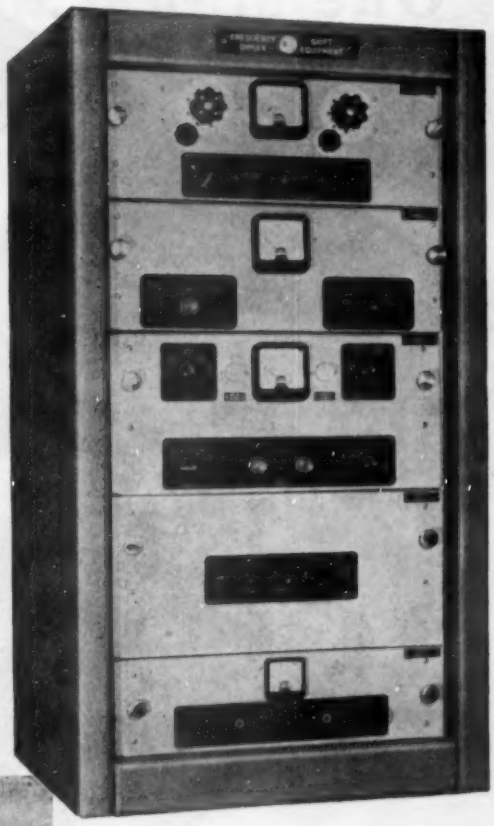


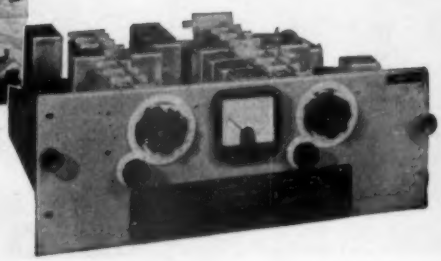
Accessibility of all components is the special feature of the new Pye receiver installed in the Nash "Metropolitan" motor car.

Frequency-Shift Diplex Drive and Keying Equipment

TYPE HD 61

Diplex or twin-channel Frequency-Shift Keying is a development of the single-channel FSK system which has proved its advantages in recent years. Diplex FSK enables two simultaneous frequency-shift telegraph channels to be operated on a single CW transmission. The Type HD 61 equipment illustrated is designed for keying most class C transmitters, including the Marconi S.W.B. series, by the diplex frequency-shift system. It also provides single-channel FSK for telegraphy and on-off keying of CW. Any one of six pre-set crystal controlled frequencies may be instantaneously selected.





The equipment comprises five units (mixer, crystal, keyer, power supply and monitor). Units may be readily removed for replacement or servicing.

MARCONI

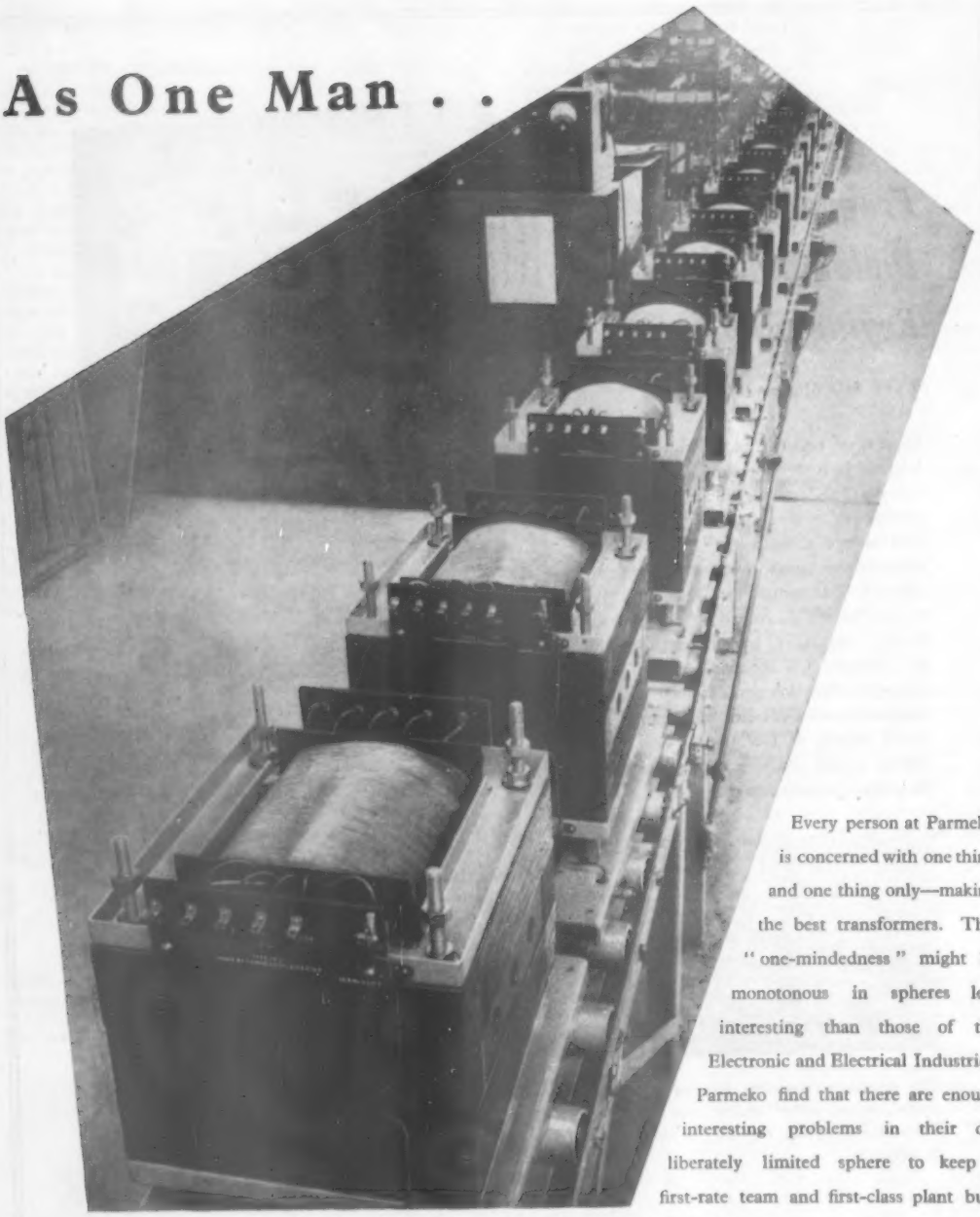
COMPLETE COMMUNICATION SYSTEMS

Surveyed, planned, installed, maintained

MARCONI'S WIRELESS TELEGRAPH CO. LTD., CHELMSFORD, ESSEX

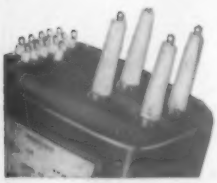
LC4

As One Man . .



Every person at Parmeko is concerned with one thing and one thing only—making the best transformers. This "one-mindedness" might be monotonous in spheres less interesting than those of the Electronic and Electrical Industries. Parmeko find that there are enough interesting problems in their deliberately limited sphere to keep a first-rate team and first-class plant busy all the year round without spreading their energies in other ways.

Orders from manufacturers all over the world keep busy . ..



The firm with the one-track mind

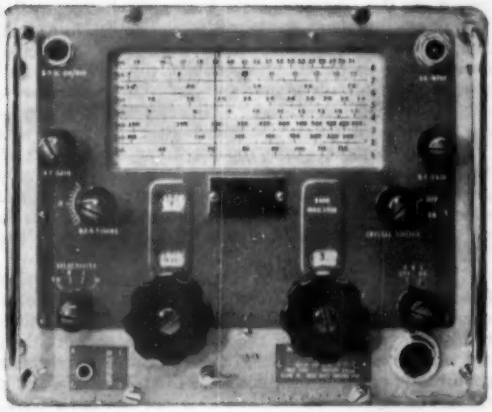
PARMEKO *of* **LEICESTER**

MAKERS OF TRANSFORMERS *for the Electronic and Electrical Industries*

Wide-Band Communication Receiver

DESIGNED TO ADMIRALTY SPECIFICATION FOR USE IN NAVAL VESSELS

Coverage : 60 kc/s to 31 Mc/s



THE set to be described was designed to conform to a fairly rigid Admiralty specification for use in ships of the Royal Navy. Approval has been given also for it to be fitted in ships of the N.A.T.O. navies. Although primarily a naval receiver it is not restricted to use in ships and either the same model, or one closely resembling it, will be available for general use before long.

As at present produced, frequency coverage is continuous from 60 kc/s to 31 Mc/s, this band being covered in eight switched ranges; the actual extent of each is outlined in the wavelength table reproduced here.

In this table, mention is made of the use of either one or of two intermediate frequencies for the various ranges and this is brought about by the fact that whilst the receiver is basically a double superheterodyne, on certain ranges the first, or high i.f., is inconvenient to use or else it clashes with the signal. To overcome this trouble the expedient is adopted of switching from double to single superheterodyne as the need arises. These changes are effected by the waveband switch and all circuits are automatically aligned for whichever mode of operation is employed.

WAVELENGTH TABLE

Range	Coverage	I.F.(s)
1	60–125 kc/s	460 kc/s
2	100–260 kc/s	
3	260–660 kc/s	1.4 Mc/s and 460 kc/s
4	0.66–1.5 Mc/s	460 kc/s
5	1.5–3.4 Mc/s	
6	3.4–7 Mc/s	1.4 Mc/s and 460 kc/s
7	7–15 Mc/s	
8	15–31 Mc/s	

I.F. SELECTIVITY TABLE

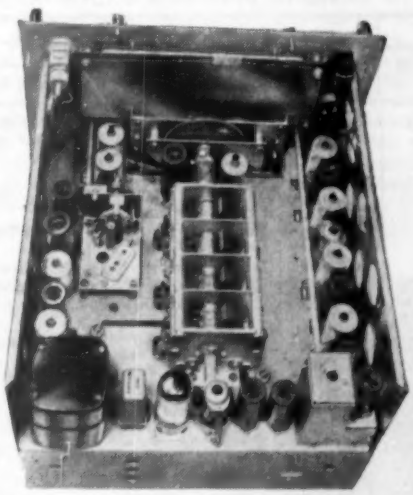
(*as single superhet*)

Response db	Wide	Intermediate	Narrow	Very Narrow
−6	6.5 kc/s	4.6 kc/s	1 kc/s	700 c/s
−20	10 kc/s	7.5 kc/s	3 kc/s	1.1 kc/s
−60	20 kc/s	15.5 kc/s	10 kc/s	4.5 kc/s

The double superheterodyne principle offers certain advantages on all but the longest wavelengths, but especially so on those below 100 metres (3 Mc/s). The wider separation between the signal and the first mixer oscillator frequencies assists circuit alignment by minimizing "pulling" and, perhaps most important of all, it gives greater freedom from second-channel interference. As the table shows, the two i.f.s used in this set are 1.4 Mc/s and 460 kc/s respectively.

As the single r.f. stage might not offer a good enough barrier to break-through of signals on the intermediate frequencies, two wavetraps are provided, one in the aerial circuit, tuned to 460 kc/s; the other in the intervalve coupling of the r.f. stage tuned to 1.4 Mc/s. They are brought in as required by the waveband switch.

The bandwidth of the i.f. amplifier can be adjusted over quite a wide range, but in four steps, not continuously. These steps are marked on the switch as "wide," "intermediate," "narrow" and "very narrow," their respective bandwidths depend on the



Chassis of the Rees Mace communications receiver, model CAT.

points on the response curve between which they are measured and these are given in the selectivity table. For the "wide" bandwidth, additional inductive coupling is switched in between the primary and secondary windings of the 460-kc/s i.f. transformers; when switched out it gives "intermediate"; interposing a double quartz crystal filter between valves V_3 and V_4 gives "narrow"; tapping the filter across part of the V_3-V_4 i.f. transformer secondary provides "very narrow." Incidentally, tapping down V_4 on the secondary of the preceding i.f. transformer obtains in all positions of the selectivity switch except the "narrow."

There are 12 valves in the receiver and the valve function table gives, in condensed form, the type of valve in each stage and its function on the various tuning ranges. Some of the valves perform more than one function at different times. The only comment required is perhaps on the use of the triode of V_2 as a crystal-controlled oscillator. It is not normally used, but when it is it replaces the tunable oscillator V_1 in the first frequency-changer circuit.

The noise limiting function performed by V_8 is for suppression of impulse noise. It is a series-parallel type in which one diode opens the a.f. signal path while the other short-circuits it. There is a threshold control to adjust the point at which suppression starts.

As a safeguard for the receiver when it is used in proximity to a transmitter, there is included a muting relay which can be operated by a subsidiary contact on the morse sending key. This applies a positive voltage to the cathodes of valves V_1, V_2, V_4 and V_5, thus effectively de-sensitizing the set.

So far as the a.f. stages are concerned it need only be said that negative feedback is applied from the anode of the output valve to the penultimate a.f. amplifier; and the output transformer provides two outputs, one at 500 ohms giving 2 W and the other at 100 ohms giving 60 mW.

The receiver, which is described as the Model CAT, is supplied by Rees Mace Marine, Oulton Works, Lowestoft, Suffolk.

VALVE FUNCTION TABLE

Position	Type	Circuit Functions	
		Ranges 1, 2, 4, 5	Ranges 3, 6, 7, 8
V_1	6BA6	R.F. Amplifier	R.F. Amplifier
V_2	ECH81	Heptode: 1st mixer to 460 kc/s circuit	1st mixer to 1.4 Mc/s
		Triode: Crystal circuit oscillator Range 5 only	Crystal circuit oscillator Ranges 6, 7 and 8 only
V_3	6C4	1st Oscillator: signal + 460 kc/s	1st Oscillator: signal + 1.4 Mc/s
V_4	ECH81	Heptode: I.F. amplifier	2nd Mixer to 460 kc/s
		Triode: not used	2nd Oscillator at 1.86 Mc/s
V_5	EF92	I.F. Amplifier at 460 kc/s	
V_6	EF92	I.F. Amplifier at 460 kc/s	
V_7	EB91	Signal detector and A.G.C. rectifier	
V_8	EB91	Noise limiter	
V_9	EF92	A.F. Amplifier	
V_{10}	6CH6	Output tetrode	
V_{11}	QS150/45	Voltage stabilizer	
V_{12}	EF92	Beat frequency oscillator	

NEWS FROM THE CLUBS

Birkenhead.—Wirral Amateur Radio Society continues to meet on the first and third Wednesdays of each month at 7.30 at the Y.M.C.A., Whetstone Lane, Birkenhead. Sec.: C. Wattleworth, 17, Iris Avenue, Claughton, Birkenhead.

Liverpool.—The Liverpool & District Amateur Radio Club (previously known as the Liverpool & District Short Wave Club) meets on Tuesdays at 8.0 in St. Barnabas Hall, Penny Lane, Liverpool, 15. The club transmitter, G3AHD, can be heard most Tuesday evenings on 160 metres. Reports on the transmissions would be welcomed. Sec.: A. D. H. Looney, 81, Alstonfield Road, Knotty Ash, Liverpool, 14.

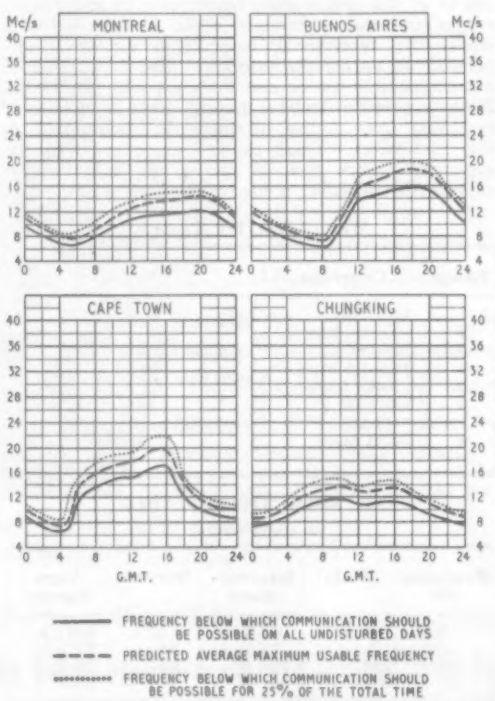
QRP.—The number of clubs which have become affiliated to the QRP Society is such that the society is planning inter-club QRP tests. It is also arranging its own exhibition for October. Sec.: J. Whitehead, 92, Rydens Avenue, Walton-on-Thames, Surrey.

Short-wave Conditions

Predictions for July

THE full-line curves given here indicate the highest frequencies likely to be usable at any time of the day or night for reliable communications over four long-distance paths from this country during July.

Broken-line curves give the highest frequencies that will sustain a partial service throughout the same period.



Negative Resistance

Two Kinds — and How to Use Them

By THOMAS RODDAM

THE idea of resistance is the starting point for most of our circuit theory: the idea of negative quantities is the starting point for an engineer's study of banking practice. If I had a copy of *Pickwick Papers* handy I would make a quick reference to Mr. Potts' assistant the Chinese metaphysician; but there, I have completely forgotten, though you no doubt know what I mean. Anyway, given the idea of resistance, and the idea of negative quantities, there is no difficulty at all in envisaging a negative resistance. So I used to think, until I started to construct a device called a negative impedance converter. My problems were recalled by "Cathode Ray" in the April issue of *Wireless World*, who wrote in a footnote (p. 195): "If you are sceptical about the sign of a parallel combination of positive and negative resistances being the same as that of the *smaller* of the two, try using the formula $\frac{R_1 R_2}{R_1 + R_2}$ to find the resistance when R_1 is, say, -15 kΩ and R_2 is $+20$ kΩ. (The answer should be -60 kΩ.)"

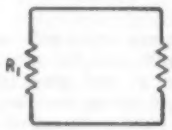


Fig. 1. Two resistances, in series or in parallel?

Now, I do not come from Missouri, but you will have to show me, and in order to convince myself that "Cathode Ray" was right I drew Fig. 1. Two resistances in parallel, R_1 and R_2, and the result, as "Cathode Ray" says, is $R_1R_2/(R_1 + R_2)$, which, if $R_1 = -15$ kΩ and $R_2 = +20$kΩ, is just -60 kΩ. But are there two resistances in parallel, or are they in series? If they are in series, the total resistance of the loop is $(R_1 + R_2)$, or $+5$ kΩ. In one view we have the makings of instability, and in the other we have a perfectly stable system. Of course, if we make $R_1 = -20$ kΩ and $R_2 = +15$ kΩ, the round-the-loop resistance is -5 kΩ, and the parallel combination is $+60$ kΩ, so that the loop is the unstable view and the parallel arrangement the stable one.

It might be suggested that somehow this is just a bit of algebraic fiddling of no practical importance, intended merely to blind you with science and give me something to write about. In fact, the distinction is one of great practical value which must be understood if any use is to be made of negative resistance circuits. In the simplest possible problem, when we wish to make a negative resistance oscillator, we must decide whether to replace R_1 by a parallel LC circuit, as in the dynatron oscillator, or by a series LC circuit, as in some of the transistor oscillators.

There are two quite independent approaches to this question of the two kinds of negative resistance, because it turns out that there are, in fact, two different sorts of negative resistance. Both these approaches depend on the fact that a practical negative resistance is only negative over a limited range of working conditions and, as we shall see, there is no obvious connecting link between the two approaches.

First of all we may follow "Cathode Ray" and plot a graph showing the relation between the voltage and current. We shall be working with the incremental resistance, the value of dV/dI, and since this is most conveniently thought of as the slope of the graph we shall take the current axis as the horizontal axis and the voltage axis as the vertical one. This is not the way we plot valve characteristics, but it is the standard method for negative resistance studies, and we shall see in a moment why we must keep to this standard.

Fig. 2 is a typical negative resistance characteristic, which is easily produced with a point transistor. It is a plot of the emitter voltage-current characteristics in a circuit with a fairly large base resistance, and for reasons which are obvious it is called an N-type characteristic. In the neighbourhood of the point P the resistance is negative, and has some value $-R_e$. Across the curve, I have drawn a load line QPS intersecting the curve at three points, of which P is unstable and Q and S are both stable. This load line corresponds to some resistance R_L, which is less than R_e. The other load line, dotted in through P, corresponds to a resistance $R'_L > R_e$, and there is only one intersection, at P, which must therefore be stable. Two special cases of these load lines are important. The one through P parallel to the I-axis, the short-circuit case, has three intersections, so that $-R_e$ is short-circuit unstable: the one through P parallel to the V-axis has only one intersection and thus $-R_e$ is open-circuit stable.

Now let us look at the base characteristic of a point transistor, shown in Fig. 3. Again we have a negative resistance region round P, and a load line QPS intersecting the curve at three points. This characteristic is that of an S-type negative resistance. You will see from the two figures why we must use the standard arrangement of axes if we want to have standard terminology. Q and S are stable intersections, while P is unstable, but this time the load resistance $R_L > R_b$.

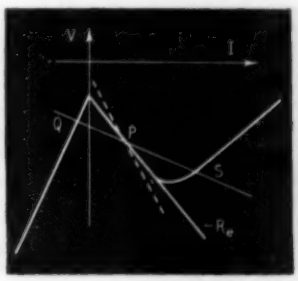


Fig. 2. One type of negative resistance characteristic, showing stable and unstable load lines through P.

The dotted load line, for $R'_L < R_b$, has only a single stable intersection, at P. Quite clearly the S-type characteristic is short-circuit stable and open-circuit unstable.

It is, I think, fairly obvious that to produce an oscillator using an N-type negative resistance we should use a controlling circuit which drops to a low resistance at the frequency we want, while to produce an oscillator using an S-type characteristic we must use a controlling circuit which rises to a high resistance at the wanted frequency. In practice we use a series LC circuit for the N-type, and a parallel LC circuit for the S-type.

How do these two kinds of negative resistance come into existence? We know that in all the circuit forms —we do not want to talk about gas-discharge tubes— there is some positive feedback somewhere in the circuit. Let us assume that we have arranged matters so that we can control this feedback, and settle down to plot the voltage-current characteristics with different amounts, starting with no feedback at all. Our first graphs will be straight lines, corresponding to some value of positive resistance. As we turn up the feedback, we find a kink developing: in the region of this kink the resistance may be either greater or less than the initial value: with more feedback still, the curve actually bends back, as you can see from Fig. 4. The S-type characteristic in Fig. 4(a) is obtained from a circuit giving an increase in resistance for small positive feedback, so that the negative resistance has been reached through infinity. The N-type characteristics in Fig. 4(b) is obtained from a circuit giving a decrease of resistance for small positive feedback, so that the negative resistance is reached through zero. Those curves can easily be plotted on an oscilloscope, and the changing shape watched as the feedback is varied. To do this, though, you must drive the single-valued co-ordinate with a "stiff" source, which means that to plot Fig. 4(a) we apply a sweep voltage and pick off the current produced, while to plot Fig. 4(b) we apply a sweep current and pick off the voltage. If you sweep the emitter voltage in Fig. 2 the current will simply cut the corners and will never show you the negative resistance region at all.

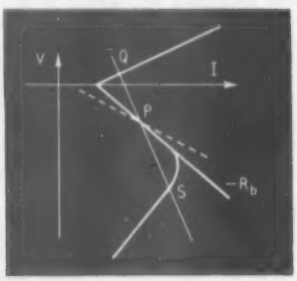
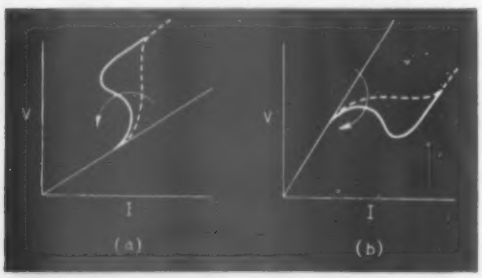


Fig. 3. The other type of negative resistance characteristic.

Fig. 4. A negative resistance can be developed by bending the V-I curve up through $R = \infty$ (a), or by bending it down through $R = 0$ (b).



This division of negative resistances into two kinds is enough to tell us how to use them, but it leaves one point completely unsettled. Suppose that we have a circuit known to be a negative resistance and that we plot a small section of the characteristics and apply a load line. All the information is given in Fig. 5: is this arrangement stable or unstable? How can the circuit know, if it is brought to the point P, whether this is an unstable condition or not? This problem seems to have been left without discussion for quite a long time. The idea that there are two types of negative resistance, the N-type and the S-type, was introduced by Crisson, who called them the series and shunt types, because this analysis was concerned with the use of negative resistance for telephone repeaters. In this application it is essential to know what happens when the repeater is not being used, which normally means that the line in which it is connected is open-circuited: a series type is perfectly safe in this condition, but a shunt type will oscillate and may disturb other equipment.

Resistance + . . .?

The approach to negative resistance which tells us why one kind is short-circuit stable and the other short-circuit unstable depends on a hard physical fact: there is no such thing as a pure resistance. Any practical negative resistance must have some capacitance and will probably have some inductance associated with it. A theoretically pure negative resistance, of its very nature, cannot lead to instability, for reasons which are beyond our scope here, but which are discussed in a paper[1] referred to at the end of this article. The stability of a negative resistance circuit is therefore determined by the actual impedance over the whole frequency range, from $-\infty$ to $+\infty$.

We can determine this impedance quite easily by using the circuit shown in Fig. 6. The variable resistance and capacitance (or inductance) elements are adjusted until the voltmeter shows a balance, when the total impedance $(R + j\omega L) - Z$, for the LR case, is zero. Obviously then $Z = R + j\omega L = R + jX$.

For each frequency we plot a point on the R, X

Below: Fig. 5. If this is all the information available, is the system stable or unstable?

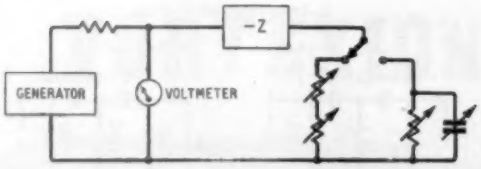


Fig. 6. Test circuit for measuring negative impedance.

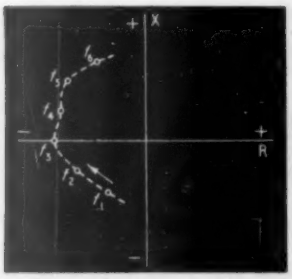


Fig. 7. The locus of the complex impedance R + jX as the frequency is increased from f_1 to f_6. This particular example shows a negative resistance.

graph shown in Fig. 7, and join the points to give a curve. When we do this we find that the graphs look something like the lower ones of Fig. 8, in which the arrow shows the direction of increasing frequency. Over on the left the two graphs are very similar, so that at some frequency both correspond to, say, —1,000 ohms, non-reactive. In order to appreciate the difference between these two curves, let us look at Fig. 8(a) and (b). We can consider these curves as the boundaries, the cages, separating two regions of the plane RX. One of these regions is *inside*, the other *outside*, and we must use a consistent rule for deciding which is which. The rule is that the Right Bank is *inside*, left and right being distinguished by looking in the direction of increasing frequency. The origin is inside in Fig. 8(a), but in 8(b) the origin is outside the boundary. The origin, of course, corresponds to a short circuit, and as it can be shown that points inside the boundary are unstable loads for a negative impedance, Fig. 8(a) corresponds to a short-circuit unstable system, while Fig. 8(b) is unstable with high impedances connected to it. The loops of Figs. 8(c) and 8(d) are not quite so obvious. The easiest way to check inside and outside here is to see how the pattern changes if it is treated as a piece of string, marked with directional arrows, and with a stick at the origin to prevent any crossing of the origin. In Fig. 8(c) the little loop on the right can easily be collapsed to a knot, so the origin is inside, as it is in Fig. 8(a). In Fig. 8(d) the small loop round the origin must be enlarged until the big kidney-shaped loop on the left collapses to a knot; Fig. 8(d) is like 8(c), with the origin outside.

These diagrams, as you will have guessed, are related to the Nyquist diagrams used in feedback amplifier theory. There is, indeed, another way of treating feedback amplifiers, by breaking the feedback path and measuring the impedance at the break, which leads to exactly these curves. If you get a curve like Fig. 8(a) or 8(c) when the feedback path is closed, the amplifier will be unstable. What we are doing in this analysis is finding the frequencies at which oscillation can take place, if it can: the noise in the circuit will build up

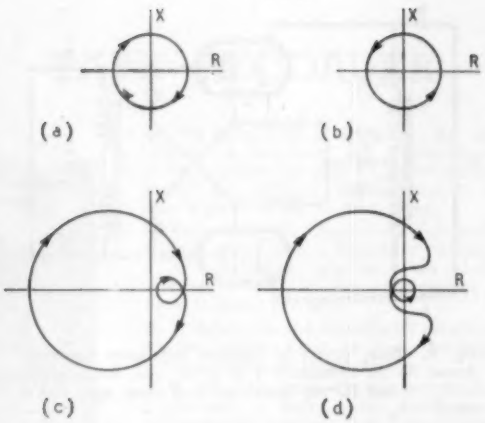


Fig. 8. Typical plots of R and X for, (a) and (c), series type and, (b) and (d) shunt type negative impedances.

at those frequencies to allow the system to trigger over to the point Q or S in the earlier diagrams.

The reader may be tempted to think that this idea of negative resistance is all very academic. Useful for oscillators, perhaps, but of no other application is the view which most of us used to take. In recent years, however, a new idea has grown up and is likely to be of great importance. It begins, for our purposes, with a method of designing negative resistance circuits of very reliable characteristics. The dynatron circuit suffers from the disadvantage that it is really a " trick circuit " depending on valve characteristics which are not strictly controlled. It works well so long as you are prepared to adjust it carefully, but it cannot be designed, built and left alone. There is, however, a very interesting circuit based on the grounded-grid amplifier which will provide negative impedances that are almost independent of the valve characteristics. In an article on the grounded-grid amplifier (May issue, p. 214) I showed that the input and output impedances of a grounded-grid amplifier with feedback from anode to grid are:

$$\text{input impedance} = \frac{\rho}{1+\mu} + \frac{1+\mu k}{1+\mu} R_g$$

$$\text{output impedance} = \frac{(1+\mu)R_l + \rho}{1+\mu k}$$

Let us now take $k = -1$. Then

$$R_{in} = \frac{\rho}{1+\mu} - \frac{\mu - 1}{\mu + 1} R_g$$

$$R_{out} = -\frac{\mu + 1}{\mu - 1} R_l + \frac{\rho}{\mu - 1}$$

If we neglect the term $\rho/(\mu \pm)$, which will be about 200 ohms, positive, we have

$$R_{in} = -\frac{\mu - 1}{\mu + 1} R_g$$

$$R_{out} = -\frac{\mu + 1}{\mu - 1} R_l$$

Since μ will be about 50 for a 12AT7, the term $(\mu - 1)/(\mu + 1)$ is very close to unity, and both R_{in} and R_{out} are approximately equal to the negative of the im-

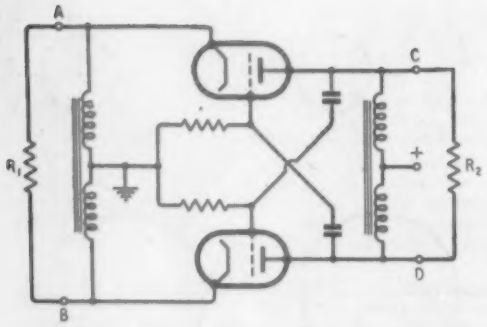


Fig. 9. Basic circuit of negative impedance converter. Across AB the impedance is of series type, and is about $-R_2$: across CD the impedance is of shunt type, and is about $-R_1$.

pedance at the other side of the valve. As you can see, if μ drops from 50 to 40, the coefficient $(\mu - 1)/(\mu + 1)$ changes only from 0.961 to 0.95.

The actual circuit used to produce this high-stability negative impedance (it is called, for obvious reasons, a negative impedance converter) is shown in Fig. 9. As you can see, it is a push-pull grounded-grid amplifier, with feedback to each grid directly from the opposite anode. The direct coupling makes $|k| = 1$, and the cross connection gives the minus sign. We can remove R_1 and see $-R_2$ across terminals C and D. In practice it is just slightly more complicated, because to make the circuit work well we will try to keep R_2 in the region of 10-30 kΩ, the sort of value which suits the valve, and if we want a low negative impedance at AB we must use an input transformer.

An interesting feature of this circuit is that it gives us a chance to work with either series or shunt types of reactive impedance. At AB the impedance is of the series type, while at CD it is of the shunt type. This result was implicit in the discussion of the way the impedances varied with k in the previous article. An amplifier of this kind, called an E1 repeater[2], is being used in America in telephone circuits: the line is broken and connected through AB. The negative impedance acts as an amplifier in both directions, quite impartially. A corresponding circuit using transistors has been described by Linvill[3], who has gone on to show[4] how a device of this kind can be used together with RC circuits to produce some quite impressive filters. One of these basic circuits, with the response obtained, is shown in Fig. 10.

I do not propose to discuss these negative resistance circuits in any more detail here, because they are both complicated and rather specialized. They are examples of the trend of modern circuit design towards a form in which the valve is so controlled in the circuit that changes in its characteristics do not affect the operation of the system. The basic theory of negative resistance, too, shows an increasing concentration on the full story of a situation. Whether you look at the V-I characteristic, or at the impedance presented at the terminals, you must investigate conditions quite a long way from the actual working region. You must, indeed, search for

"... The five unmistakable marks
By which you may know, wheresoever you go
The warranted genuine Snarks."

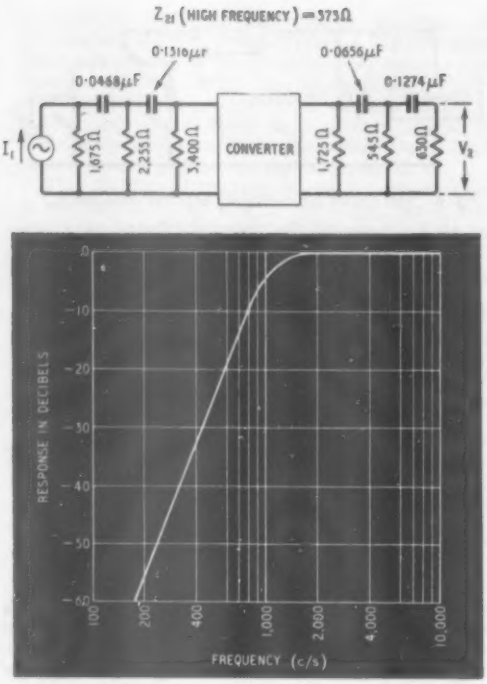


Fig. 10. High pass filter using transistor negative impedance converter.

And then, having made your negative resistance, and decided how you are to use it,

"I feel it my duty to say,
Some are Boojums . . ."

References

[1] "Some Fundamental Properties of Transmission Circuits," by F. B. Llewellyn, *Proc. I.R.E.*, Vol. 40, p. 271, March, 1952.

[2] "Theory of the Negative Impedance Converter," by J. L. Merrill, Jr., *B.S.T.J.* Vol. 30, p. 88, Jan, 1951.

[3] "Transistor Negative Impedance Converters" by J. G. Linvill, *Proc. I.R.E.*, Vol. 41, p. 275, June, 1953.

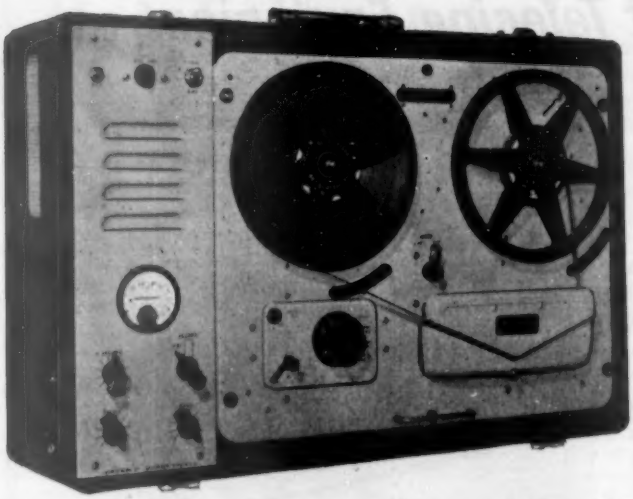
[4] "RC Active Filters" by J. G. Linvill, *Proc. I.R.E.*, Vol. 42, p. 555, March, 1954.

"The Oscilloscope at Work"

ALTHOUGH the cathode-ray oscilloscope has become an everyday tool in radio, not everybody realizes its full potentialities. A new *Wireless World* book "The Oscilloscope at Work" by A. Haas and R. W. Hallows, M.A. (Cantab), M.I.E.E., is therefore likely to open a good many people's eyes to just what can be done with this versatile instrument. After a description of the c.r.o. itself the book starts with a general chapter on the investigation of electrical properties such as voltages, frequencies and phase relationships, also including such topics as Lissajous figures, circular time bases and hysteresis—loop traces. The remaining chapters deal with the use of the c.r.o. on amplifiers, oscillators, rectifiers and detectors, modulators, phase-shifting circuits and finally television receivers. Oscilloscope operating troubles are also discussed as are various refinements and accessories to the instrument.

The book is liberally illustrated with 217 oscillograms and 102 diagrams. It is available from booksellers at 15s or direct from our Publishers at 15s 6d by post.

VORTEXION TAPE RECORDER



The amplifier, speaker and case, with detachable lid, measures 8¼in. x 22½in. x 15¾in. and weighs 30 lb.

PRICE, complete with WEARITE TAPE DECK £84 0 0

★ The noise level is extremely low and audibly the hum level and Johnson noise of the amplifier and deck are approximately equal. Only 25% of this small amount of hum is given by the amplifier alone.

★ Extremely low distortion and background noise, with a frequency response of 50 c/s.—10 Kc/s., plus or minus 1.5 db. A meter is fitted for the measurement of signal level and bias level.

★ Sufficient power is available for recording on disc, either direct or from the tape, without additional amplifiers.

★ A heavy mu-metal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 micro-volts approximately to fully load.

★ The .5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.s, microphone or radio inputs.

★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

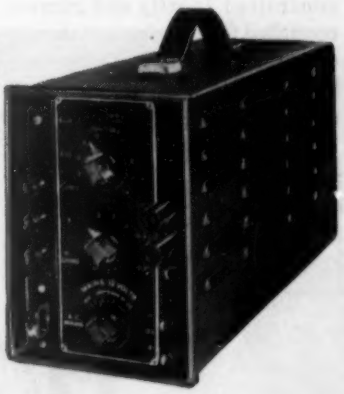
★ The power output is 3.5 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.

★ Facilities are provided for using the amplifier alone and using power output or headphones while recording or to drive additional amplifiers.

★ The unit may be left running on record or play back even with 1,750 ft. reels with the lid closed.

POWER SUPPLY UNIT to work from 12 volt Battery with an output of 230 v., 120 watts, 50 cycles within 1%. Suppressed for use with Tape Recorder. **PRICE £18 0 0.**

TYPE C.P.20A AMPLIFIER



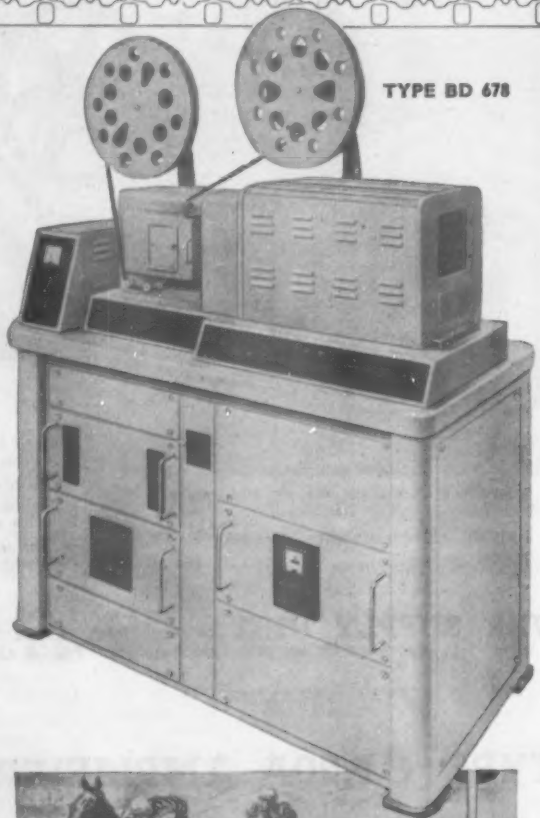
For A.C. Mains and 12 volt working giving 15 watts output, has switch change-over from A.C. to D.C. and "Stand-by" positions. Consumes only 5½ amperes from 12 volt battery. Fitted with mu-metal shielded microphone transformer for 15 ohm microphone, provision for crystal or moving iron pick-up with tone control for bass and top. Outputs for 7.5 and 15 ohms. Complete in steel case with valves. **PRICE £30 16 0.**

Manufactured by

VORTEXION LIMITED, 257-263, The Broadway, Wimbledon, London, S.W.19

Telephones: LIBerty 2814 and 6242-3 Telegrams: "Vortexion, Wimble, London."

Flying Spot Telecine Equipment



TYPE BD 678

The equipment provides a television picture of exceptionally high quality from 16 mm. films and 2 x 2 in. miniature film slides. A 'fast pull down' type of film projector is used and a similar mechanism serves for television systems having field repetition rates of either 50 or 60 fields per second. Thus any type of fixed or moving prism system is obviated.

The 16 mm. Projector, Turret Slide Scanner, Optical Change-over Assembly, Flying Spot Scanning Unit and the PEC Amplifier are mounted on top of the steel cabinet which houses the auxiliary units and power units.

The equipment can be fully controlled locally and remote controlled for stopping and starting of the film projector, change-over from film to slides and selection of any one of eight slides.

Editions of the BD 678 are available for 405, 525, or 625 line systems

MARCONI

Complete Broadcasting and Television Systems

Marconi Equipment has been installed in every one of the B.B.C. Television transmitter stations and in the U.S.A., South America, Canada, Italy and Thailand

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED · CHELMSFORD · ESSEX

LB 2

The Diode Rectifier in Valve Voltmeters

(*Concluded from p. 286 of the previous issue*)

Limitations of Use Imposed by Specified Maximum Erro

By M. G. SCROGGIE, B.Sc., M.I.E.E.

THE mathematical derivations of the results now to be given will be omitted; they have been submitted for publication in *Wireless Engineer*. The basis of the calculations is the fact that under steady a.c. conditions the charge taken in by a capacitor during each whole cycle must be equal to the discharge. In circuits (a) and (b) of Fig. 2 the capacitor C is charged during the period when the diode conducts (which with our assumed diode is when the anode is more positive than the cathode). The resistance is then only the generator resistance R_s (including the forward resistance of the diode), and the charging voltage is the instantaneous voltage of E, minus the voltage to which C is charged. To exclude the complication of a simultaneous error due to C not being large enough in relation to the frequency, and also to make the calculations much easier, C is assumed to be so large that the cyclical variations of voltage across it are negligible. Circuits (c) and (d) are at best complicated enough, for in addition to C_1 being charged by E there are some periods when it is being charged by C_2. In circuit (a) C is discharging through R all the time. In (b) it is discharging through R and the source impedance (R_s) in series when the diode is non-conducting. In (c) and (d) the equating of charge to discharge must be done for both C_1 and C_2.

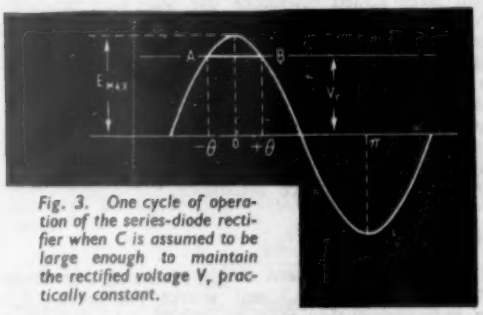


Fig. 3. One cycle of operation of the series-diode rectifier when C is assumed to be large enough to maintain the rectified voltage V_r practically constant.

Fig. 3 illustrates the comparatively simple operation of circuit (a). V_r being the practically constant voltage to which C is charged, it is only exceeded by the input voltage near the positive peak, from A to B. This is the period during which the diode conducts. It is best referred to in terms of angle; if the positive peak is taken as the starting point, the conducting period lasts from $-\theta$ to $+\theta$. This is the charging period for a whole cycle ; for half a cycle (0 to π) it is 0 to θ. These angles are all reckoned in radians (π radians = 180 degrees). This angle of conduction, θ, is in every case the king pin of the whole calculation. Given θ, the corresponding value of R_s/R can be calculated; in the series circuit it is $(\tan\theta - \theta)/\pi$. And from Fig. 3 it is obvious that $V_r = E_{max}\cos\theta$. The graph of V_r/E_{max} against R_s/R was plotted by calculating each of them for a number of assumed values of θ.

In the shunt circuit V_r is not a constant voltage; it is the average value of V_{ad} (Fig. 4), which is a sine wave, $R/(R + R_s)$ times the amplitude of that generated by E, and with the positive peak clipped short and pushed down to zero level. Seeing that in this and other ways the shunt circuit differs markedly from the series circuit, it is rather surprising that R_s/R and V_r/E_{max} in terms of θ turn out to be the same. Fig. 5, which except for changed symbols and experimental plots is a repetition of Fig. 6 in the March 1952 article, therefore serves for both circuits. Incidentally, with the diodes connected as in Fig. 2 the polarity of V_r in the shunt circuits is opposite to that in the series circuit. The values of R_s used for plotting were the values actually inserted during the experimental readings, augmented by 450 Ω, — the estimated average forward

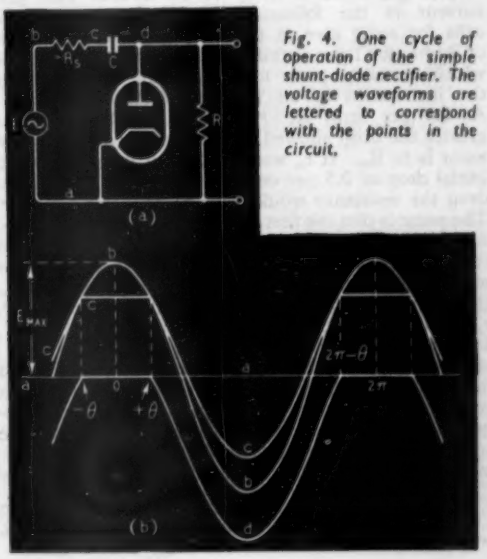


Fig. 4. One cycle of operation of the simple shunt-diode rectifier. The voltage waveforms are lettered to correspond with the points in the circuit.

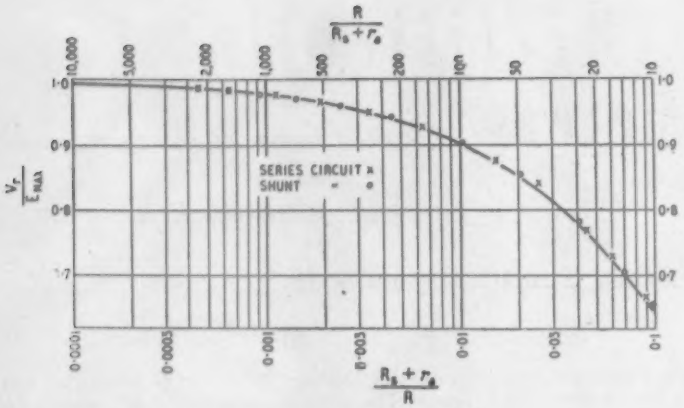


Fig. 5. (Left) Graph showing the efficiency of rectification V_r/E_{max} as a function of series resistance in the series-diode rectifier. It also applies exactly to the shunt-diode circuit if either R_s or r_a is zero, and nearly exactly for any values of R_s and r_a within the limits of the curve shown. The prints relate to experimental readings with the shunt and series circuits.

resistance r_a of the diode used (EA50) plus the initial resistance of the 50 c/s source. R was 1MΩ and C, 1μF. The theoretically calculated curve is well supported by the experimental readings.

As already mentioned, however, this graph does not show the 99 per cent region clearly, and Fig. 6 is an enlargement of this part, plotted as percentage error. Because the values of $(R_s + r_a)/R$ are so small, a reciprocal scale of $R/(R_s + r_a)$ has been added as an alternative. This shows how many times bigger R must be than R_s if the error due to R_s is to be as shown by the curve. The value of θ for 1 per cent error ($V_r/E_{max} = \cos\theta = 0.99$), is 8.1 deg., so the total conduction angle is 16.2 deg. out of the whole 360-deg. cycle. R has to be over 3,000 times $R_s + r_a$, and the peak current taken from the source (at 0 deg.) is 30 times the average current in the load resistance R. Under these conditions, θ in radians is so nearly equal to tan θ that four-figure tables are barely enough for calculating $(R_s + r_a)/R$, and at 2 deg. it is necessary to use seven-figure tables.

If, in order to minimize the effect of R_s, R is made very large, there is likely to be trouble with grid current in the following amplifier[3]; even 10MΩ calls for some care in that respect. And the value of $R_s + r_a$ for 1 per cent drop is even then only 3,100Ω, which certainly gives no justification for regarding the instrument as an infinite-resistance voltmeter! At 0.5 per cent, $R_s + r_a$ is only 1,000Ω. But the greater the drop allowed, the less sensitive the instrument is to R_s. If r_a were 1,000Ω, it would cause an initial drop of 0.5 per cent; but the next 0.5 per cent drop the resistance would have to be 2,100Ω greater. The point is that the first 0.5 per cent would be allowed for in the calibration. Following this idea, we find from Fig. 5 that to reduce V_r/E_{max} to $1/\sqrt{2}$, so that with a sinusoidal input V_r would be equal to E_{rms}, $(R_s + r_a)/R$ is 0.068, so with R = 10MΩ and $R_s = 0$, r_a would have to be 0.68MΩ; and to reduce V_r by 1 per cent from this level would necessitate an R_s of 31kΩ, so this dodge gives very nearly a ten-fold improvement. Carried to this length, however, it could not be expected to be satisfactory at radio frequencies, owing to stray capacitance shunting the comparatively large series resistance needed to augment r_a. Another objection is that whereas with low

[3] "Valve Voltmeter without Calibration Drift." *Wireless World*, Jan. 1952, p. 14.

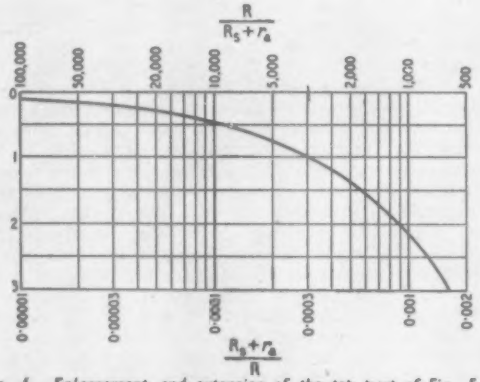


Fig. 6. Enlargement and extension of the top part of Fig. 5 to show small errors more clearly.

series resistance the diode voltmeter does read very nearly the peak voltage regardless of waveform, with large added resistance the waveform relationship is not at all clear. Nevertheless, for measuring sinusoidal low-frequency voltages in high-impedance circuits it is worth considering. Another advantage is that it greatly improves the linearity of the diode. As a compromise, for general purposes, enough resistance could be incorporated to cause a drop of a few per cent, to be absorbed in the calibration; even such a small resistance would materially reduce the sensitiveness to source resistance.

Diode Resistance

In all this we have been tacitly assuming that diode forward resistance (r_a) and source resistance (R_s) are indistinguishable in their effects. In Fig. 2(a) this is obviously true, but not necessarily in (b). Fig. 7 shows the diode resistance (with or without added series resistance) separately. The diode, while it is conducting, does not now completely short out R, as was assumed in the calculation for Fig. 2(b), and the total resistance is R_s in series with r_a and R in parallel. In spite of this, V_r still turns out to be $E_{max} \cos\theta$, but $(\tan\theta - \theta)/\pi$ is no longer $(R_s + r_a)/R$ but $\frac{R_s + r'_a}{R - r'_a}$, where r'_a is the resistance of r_a and R

in parallel. If $R_s=0$, this comes to r_a/R, so R_s and r_a are interchangeable. The only difference is when both are present at once; and even in the worst case (when they are equal) the inaccuracy in using Fig. 5 with its $(R_s+r_a)/R$ instead of $(R_s+r'_a)/(R-r_a')$ is hardly perceptible, right down to V_r/E_{max}=about 0.7.

We now come to the filtered shunt circuits, Fig. 2(c) and (d). It would be pleasant if from the values of R_1 and R_2 an equivalent could be found to R in the unfiltered circuits, so that the same V_r/E_{max} curve could be used; but this does not seem to be possible. However, if V_r/E_{max} is plotted against $(R_s+r_a)/R_1$ in Fig. 2(c) and $(R_s+r_a)/(R_1+R_2)$ in (d), not only are these two curves identical for any given value of R_1/R_2, but for reasonable values of R_1/R_2 the curve begins by following the one in Fig. 5 so closely as to be hardly distinguishable from it, and only deviates seriously below it when the R_s error is more than about 10 per cent. Where with the unfiltered circuits V_r/E_{max} is 0.7, with filtered circuits in which $R_1/R_2=1.85$ (for example) it is 0.64. This curve also is confirmed by experiment.

The outstanding and convenient fact is that for *all* the circuits considered Fig. 6 is either correct or near enough, if for Fig. 2(c) and (d) R is replaced by R_1 and R_1+R_2 respectively and R_1 is not large compared with R_2.

The procedure for calculating the error in measuring the voltage across a *resonant* circuit when r_a is not negligible, or there is other resistance (R_s) in series, or both, is first to reckon the drop of voltage across the resonant circuit due to the R_s of the rectifier connected to it, and then, regarding this reduced value as E, to find the additional R_s+r_a error as has been shown.

Filter Capacitor

The remaining question concerns the value of C (or C_1 and C_2). It is sometimes supposed, or at least implied, that the principle at work is the same as in the ordinary valve coupling, Fig. 8. Here, to pass 99 per cent of the applied voltage to the valve, fCR must be 1.12; so at 50 c/s CR must be 0.0224 megohm-microfarads. But in the diode rectifier this mode of calculation does not apply, even if R_i (or any other value of resistance) is substituted for R. The relationship is much more subtle. For one thing, it is bound up with what we have just been studying—R_s.

The calculation of fCR error, even for the simple series-diode circuit and after making various simplifying assumptions, is more difficult.† On the assumption that $R_s=0$, Bell's method leads to the simplified result:

$$\frac{V_r}{E_{max}} \simeq \frac{1+\cos\alpha}{2}$$

where α is the conduction angle, given by

$$\exp.\left(\frac{\alpha/2\pi-1}{fCR}\right) = \cos\alpha$$

Fig. 9 is a graph of this, in the form of percentage error against fCR. Owing to the simplifying assumptions, and the fact that series resistance never is entirely absent, it is not safe to regard this graph as giving more than a rough idea. It can, however, continue to give a rough idea even when R_s is not zero, for, as Bell has pointed out, R_s has little effect on the combined R_s and fCR error until the R_s-alone error curve overtakes the fCR error curve. In other words, one can adapt a R_s curve such as Fig. 5 to a finite value of C by plotting at its left-hand margin the level found from Fig. 9, and continuing this level as a horizontal line until it merges into the downward sweep of the original curve.

This result was obtained by Bell for the series-diode circuit only. The experience we have already obtained might lead us to expect that it would not be drastically different for the simple shunt circuit. And experiment confirms this, the readings with the shunt circuit being indistinguishable from those with the series circuit. Fig. 10 shows the infinite-fCR curve of Fig. 5 with the addition of measured plots for a number of finite values of fCR. They were actually read in the simple shunt circuit, but can be taken as applying to the series circuit. It is interesting to note that fCR=1, which in Fig. 8 causes a loss of just over 1 per cent, in rectifier circuits causes a loss of 30 per cent.

How about the effect of the filters on fCR error? There is, of course, the complication of the filter capacitor C_2. As it happens, its value has much less effect than that of C_1 on the efficiency of rectification; so long as fC_2R_2 is not less than about 2 it is practically the same as infinity. We have already seen that the addition of either type of filter to the simple shunt circuit causes the R_s error to increase somewhat, the increase being greater the greater the value of R_1/R_2,

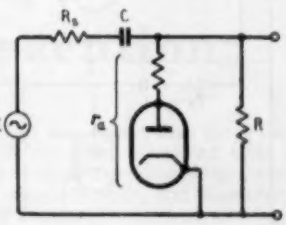
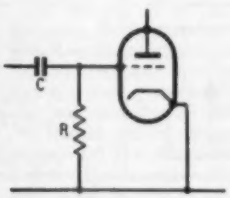


Fig. 7. When the diode forward resistance r_a is greatly augmented by series resistance, its effect is not precisely the same as that of the same amount of resistance added to R_s.



Left: Fig. 8. The voltage loss caused by C in this type of circuit is far less than that in a diode circuit with equal CR.

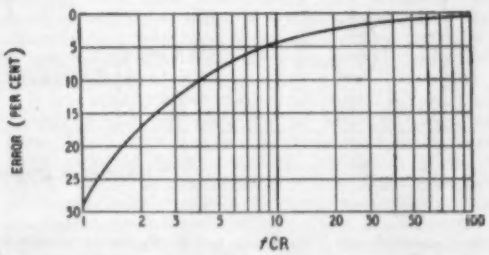


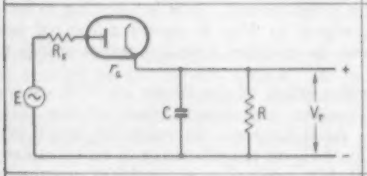
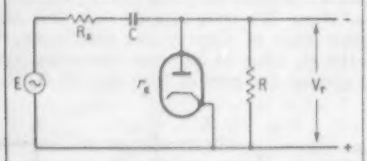
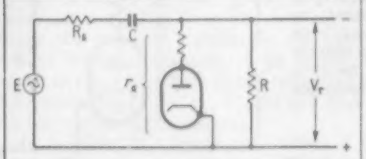
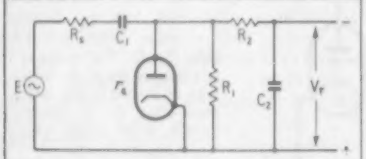
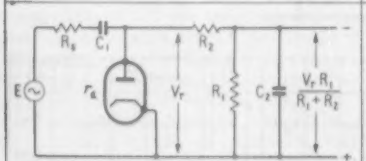
Fig. 9. Approximate low-frequency error curve calculated by Bell's method for series-diode circuit on the assumption that $R_s + r_a$ is negligible.

† See reference (2) (D. A. Bell) and also J. Marique, *Wireless Engineer*, Jan. 1935 pp. 17–22.

and that for practical values of R_1/R_2 the increase is negligible if the original R_s error is only a few per cent. The same can be said of the effect of the filter on errors caused by fC_1R_1 being too small. Actually, other things being equal, the increase of error is greater with fC_1R_1 error than with R_s error, but it is still negligible with small errors, unless R_1/R_2 is exceptionally large.

Fig. 10 shows that, just as a little initial r_a drop has the advantage of reducing errors due to R_s, so does a fCR error. But whereas the r_a drop can be absorbed into the calibration, the fCR drop depends on frequency, so ought to be avoided at all working frequencies. However, as Fig. 10 again shows, the r_a drop is not only beneficial in reducing liability to R_s error, but also reduces fCR error, or (to put it another way) enables a smaller value of C to be used than would otherwise be necessary. The point of this is that even r.f. valve voltmeters usually have to be calibrated at 50 c/s, and for a.f. purposes it may be desirable to go down to 20 c/s without serious error. If the initial resistance drop is made negligible by using a low-resistance diode and no other internal series resistance, the minimum value of CR (time constant) needed to restrict the fCR error at 50 c/s

TABULATED SUMMARY OF FORMULAE

CIRCUIT	$\frac{V_r}{E_{MAX}}$	$\frac{\tan\theta-\theta}{\pi}$	WHEN $\frac{V_r}{E_{MAX}} = 0.99$	R_L (APPROX)
	$\cos\theta$	$\frac{R_s+r_a}{R}$	$\frac{R_s+r_a}{R} = 0.0005$	$\frac{R}{2}$
	$\cos\theta$	* $\frac{R_s+r_a}{R}$	* $\frac{R_s+r_a}{R} = 0.0005$	$\frac{R}{3}$
	$\cos\theta$	$\frac{R_s+r_a'}{R-r_a'}$ WHERE $r_a' = \frac{R r_a}{R+r_a}$	* $\frac{R_s+r_a}{R} = 0.0005$	/
	$\cos\theta\left(1-\frac{R_1}{R_2}\cdot\frac{\tan\theta-\theta}{\pi}\right)$ $= \cos\theta\left(\frac{R_2}{R_2+R_s+r_a}\right)$	$\frac{R_s+r_a}{R_1+(R_s+r_a)R_1/R_2}$ $\left[\frac{R_s+r_a}{R_1} = \frac{1}{\frac{\pi}{\tan\theta-\theta}-\frac{R_1}{R_2}}\right]$	* $\frac{R_s+r_a}{R_1} = 0.0005$ IF $\frac{R_1}{R_2}$ NOT LARGE	$\frac{R_1R_2}{R_1+3R_2}$
	$\cos\theta\left(1-\frac{R_1}{R_2}\cdot\frac{\tan\theta-\theta}{\pi}\right)$ $= \cos\theta\left(\frac{R_1+R_2}{R_1+R_2+(R_s+r_a)R_1/R_2}\right)$	$\frac{R_s+r_a}{R_1+R_2+(R_s+r_a)R_1/R_2}$ $\left[\frac{R_s+r_a}{R_1+R_2} = \frac{1}{\frac{\pi}{\tan\theta-\theta}-\frac{R_1}{R_2}}\right]$	* $\frac{R_s+r_a}{R_1+R_2} = 0.0005$ IF $\frac{R_1}{R_2}$ NOT LARGE	$\frac{(R_1+R_2)R_2}{R_1+3R_2}$

* *Indicates an approximation with negligible error.*

It is assumed that fCR, fC_1R_1 and fC_2R_2 are large enough to keep voltage across C, C_1 and C_2 constant (formulae given are practically correct if fCR and fC_1R_1 are over 100 and fC_2R_2 over 2). V_r is the mean rectified voltage. θ is half the angle of diode conduction, in radians. The values given for R_L are those to which R_L tends as V_r/E_{max} tends to 1. In the second circuit the diode resistance r_a is assumed to be much less (not more than a few per cent) of R, but the third case covers augmented values. Plotting $\cos\theta$ against $(\tan\theta - \theta)/\pi$ gives a graph of V_r/E_{max} in terms of R_s, etc., as in Figs. 5 and 6.

to 1 per cent and at 20 c/s to 2 per cent is about 1 (e.g. R = 10MΩ and C = 0.1μF) and that is so large as to make the response of the instrument to changes of voltage rather sluggish. Also the capacitor is inclined to be rather bulkier than one cares for use at high r.f. One solution for a general-purpose diode voltmeter is to use a small C in a probe head for r.f. and to augment it by a large C when measuring at low frequencies. But for a purely a.f. instrument the sluggish action can be avoided by augmenting the resistance of the diode. As Fig. 10 shows, if r_a/R at $R_s = 0$ is made 0.03, the fCR error is less even when fCR is as low as 5 than it is with fCR = 50 when r_a is small.

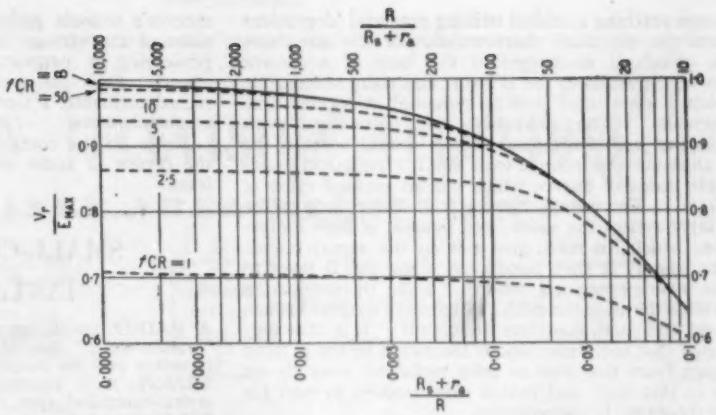


Fig. 10. The dotted curves are measured characteristics of a shunt-diode circuit, but may be taken as applying also to the series circuit. The full-line curve is the theoretical characteristic as in Fig. 5.

Summing up, one can hardly avoid the conclusion that for measurements at a.f. only, in circuits that may have high impedance, one would be well advised to consider the type in which a stabilized pre-amplifier is used, not only to extend the linear ranges to low voltages, but also to reduce error from source impedance. If, for simplicity, the unamplified diode is used, its performance can be improved by incorporating series resistance. At r.f. this is undesirable, but as high-impedance r.f. circuits to be measured will in the majority of cases be resonant, there is less need for it.

Long-distance V.H.F. Reception

A PHENOMENON which is associated with electrical discharges in the lower atmosphere has been recently encountered in the long-distance reception of v.h.f. signals, and is described by G. A. Isted in the current issue of *The Marconi Review*.

During some experiments which involved the automatic recording, in great detail, of the Kirk o' Shotts (53.25 Mc/s) and Wenvoe (63.25 Mc/s) sound channels at Great Baddow, Essex, it was observed that the signals often arrived in a succession of impulsive bursts, having a duration between 0.1 sec and 1.0 sec, and varying in amplitude between 5 and at least 20 db above the very weak background signal. The distances involved are 330 miles to Kirk o' Shotts and 180 miles to Wenvoe. It was found that the signal bursts often took the form of trains, consisting of bursts equally spaced in time, and that, apart from single bursts, there were many such trains consisting of from two bursts up to six or seven in number. The burst activity on the Wenvoe signals was much less than on those from Kirk o' Shotts, but at times there was strong evidence that a certain arrangement of signal bursts from Kirk o' Shotts occurred on the Wenvoe signals at a slightly different time.

By arranging one receiving channel to record the Kirk o' Shotts signal (and also the radio energy from a lightning flash) and another to record the lightning energy only (by detuning it from the Kirk o' Shotts frequency), a simultaneous recording system was set up which permitted identification of the signal bursts and lightning flashes. It was found that the trains of signal bursts were very often associated with a lightning flash, the bursts sometimes preceding, sometimes occurring simultaneously with, and sometimes following the lightning flash.

By the use of a "static receiver" connected to a recorder, the electrostatic clicks which it received, and which indicate rapid changes of an electric field in the atmosphere not necessarily due to lightning flashes, were also found to be closely associated with the trains of signal bursts.

Vertical incidence inospheric recordings of pulse-signals on 10.6 Mc/s were then examined, and these showed the presence of sporadic scatter points of high ionization density at heights corresponding roughly to that of the E layer, and having durations and time spacings similar to those of the signal bursts. These ionospheric echoes also often occurred in trains and it was found that they were often associated with lightning flashes.

It was concluded that the v.h.f. signal bursts (such signals would not normally be reflected from the ionosphere) were due to reflection from these short-lived localized patches of high ionization in the E layer. They are attributed to recurrent electrical discharges from clouds in the lower atmosphere, these discharges not necessarily amounting to lightning.

After an examination of the relevant meteorological information a theory is put forward to account for this. It is suggested that certain types of cloud in the lower atmosphere become charged until, the

charge reaching a critical striking potential (dependent upon the electrical characteristics of the air above the cloud), it discharges in the form of a current flowing upwards to the E layer; and then, recharging, reaches the critical striking potential at regular time intervals. (The relaxation time connected with charging and discharging clouds would seem to be in close correspondence with that for triple and quadruple trains of bursts, which has an average value of 4.0 sec.) The energy flowing from the clouds to the E layer causes the short-lived patches of high ionization, which, in turn, give rise to the signal bursts. The energy is then conducted along the E layer to fine weather regions, where it leaks by conduction through the air to the earth. (Lightning flashes between cloud and earth complete the circuit.) It is also suggested that more continuous ionization in the E layer (apart from that due to solar radiation) may be set up in this way, and that it may account in part for the Sporadic E phenomenon.

Whether or not these theories are proved to be correct, the experimental evidence is extremely interesting, and the author is to be congratulated upon the very lucid and painstaking way in which he has presented it. A lot of work must have gone into this project, as a result of which our knowledge of radio propagation and related phenomena cannot fail to be enhanced. T. W. B.

SOUNDS—PAST AND PRESENT

AS a prelude to the British Sound Recording Association's annual convention and exhibition, held recently at the Waldorf Hotel, London, W.C.2, Brian George, of the central programme department of the B.B.C., gave a talk on "Voices and Sounds from History," illustrated by examples from the B.B.C.'s record archives. These included the voices of Alfred Lord Tennyson and Gladstone—transcribed from phonograph cylinders, the "home recording" of that day—and Mr. George spoke of the difficulties of authenticating early records of celebrities in view of the many examples of amateur mimicry which still survive and are discovered from time to time. Not all the records are of the great; the B.B.C. archives contain specimens of contemporary wit and dialect, from people in all walks of life. Much effort is being expended to trace among the older generations the rich dialects that are in some danger of losing their edge as the result of the tendency towards standardization in the accents of B.B.C. announcers.

Guests at the annual dinner included Sir Noel Ashbridge and Harold Bishop.

After two years' service H. Davies is retiring as president and will be succeeded by Norman Leevers.

Both Saturday and Sunday attendances at the exhibition were high, and on both days visitors were able to hear demonstrations of high-quality commercial reproducers.

This year's competition for amateur constructors showed a wide range of interests and no falling off in enthusiasm. The President's Trophy and the *Wireless World* prize were won by G. M. Simpson for his cathode-ray oscilloscope, designed for work on wide-frequency-range sound recording and reproduction. Made from surplus parts and incorporating a 2½in VCR139A tube, this instrument was notable for the very high standard of workmanship and finish. The Committee prize went to A. G. Tucker for an experimenter's console giving quick access to the undersides of the various chassis for modifications, while presenting a permanently neat appearance when closed. Principal sections included a three-speed record turntable, a tape deck, a radio feeder unit and a control panel.

Notes on the commercial exhibits are included in the review of audio developments elsewhere in this issue.

SMALL-CRAFT RADIO INSTALLATION

A RADIO installation intended for the smaller and "middle-water" type of fishing craft and providing for reception over the ranges 45 to 131 kc/s and 375 kc/s to 3.4 Mc/s; radio telephone transmission on any of six crystal-controlled spot frequencies in the band 1.6 to 2.85 Mc/s and direction-finding facilities has been introduced by the Marconi International Marine Communication Company, Chelmsford, Essex.

Controls are reduced to a minimum while retaining full flexibility to meet widely different conditions of operation and all are fitted with knobs that can be handled while wearing gloves.

The aerial is a single loop in a rotating frame controlled by a large handwheel from below and it is intended to be mounted above a wheelhouse or chart-room housing the radio equipment.

The receiver, known as the "Renown," and the transmitter ("Guillemot") are approximately the same size and can be mounted very conveniently one above the other in a recess as shown in the illustration. "Seapilot" is the direction-finding equipment.

The equipment is designed for operation from 24-volt batteries.

Renown-Guillemot-Seapilot radio-telephone and direction-finding equipment introduced by Marconi Marine.

MODERN TELEVISION TECHNIQUE

FRINGE AREA RECEPTION

Before setting out to design a receiver for Fringe Areas, a number of tests were made to determine the requirements. The first showed that increased gain, whilst essential, was not in itself enough and that a reduction in the bandwidth was detrimental.

Under these severe conditions the noise grain produced by a high gain wide band vision receiver consists of a very fine dot structure which disappears when viewed at the correct distance, i.e. when the lines are not noticeable. The narrow band receiver on the other hand produces a much coarser grain, and this is far more visible and objectionable.

The limit of gain is set at some point where the amplified signal is considerably less than the aggregate of noise due to cosmic radiation, man-made static and receiver noise. A picture under these conditions has but two tones, grey, and noise modulated by whiter than grey signals. Its entertainment value over long periods may be doubtful, but it is still possible to derive information from it and many viewers in remote areas are prepared to accept pictures of this standard pending increased coverage by the B.B.C. The experiments showed that careful attention to the aerial, feeders, input valve and mixer circuits enable signals as low as two or three micro-volts on Band 1 to be considered in this category and displayed in a worthwhile form.

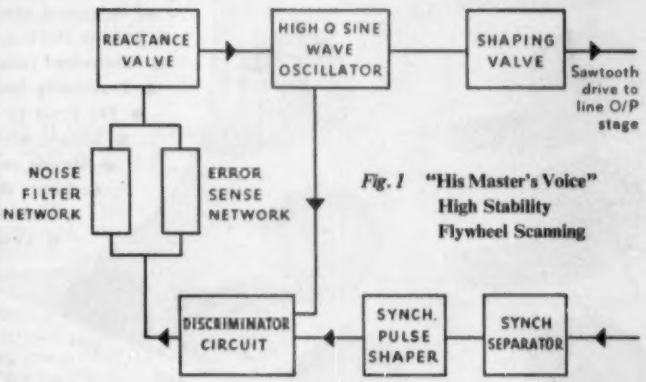


Fig. 1 **"His Master's Voice" High Stability Flywheel Scanning**

Also present with noise of low amplitude is a snowstorm of man-made and natural static impulses, capable of overloading the cathode ray tube. It is, therefore, essential not only to limit these impulses but to reduce their intensity so that they merge with the grey tone. The "His Master's Voice" impulse inverter circuit behaves admirably under these conditions discriminating easily between the low amplitude wanted signals and the high amplitude noise.

Experiments conducted by "His Master's Voice" have shown that the entertainment value from a noisy signal is greatly enhanced when viewed on a receiver controlled by clean synchronizing pulses, and that by averaging the synch. information over a period of at least ten frames, ragging or wobble of the picture is eliminated.

To obtain full value from a noisy signal entails the use of synchronizing circuits fundamentally improved in design over conventional ones. Such a circuit requires to be of extremely high stability yet sensitive to control so that, providing an occasional burst of synchronizing information is received within the ten frame period, an unbroken picture is maintained.

A schematic diagram showing a flywheel scanning arrangement which meets this requirement is shown in figure 1. Circuits, which do not employ highly stable oscillators, and hence which have to average the synch. information over a much shorter period give markedly inferior performance and were therefore discarded by "His Master's Voice" engineers, when designing Model 1828.

Experience in the field has shown that in areas where the mean signal level is less than 25 micro-volts the slow fades that occur, say, between daylight and darkness, can vary the signal down to below 5 micro-volts and above 50.

In addition, certain weather conditions, and cloud reflections produce signal cancellation and signal addition resulting in variations from one to a hundred micro-volts. Furthermore, the sound and vision signals do not vary in sympathy. It is, therefore, essential that a fringe model should be equipped with two highly efficient AGC systems operating independently on sound and vision, capable of maintaining the output appreciably constant with variations of input ranging from five micro-volts to at least 200. AGC systems which are designed ostensibly to deal with aircraft flutter and which begin to operate only at twenty-five to fifty micro-volts are obviously useless for fringe area reception. Furthermore, the AGC circuit must not be dependent on the line output circuit, since transmission phase shifts and variable delays produce objectionable gain fluctuation.

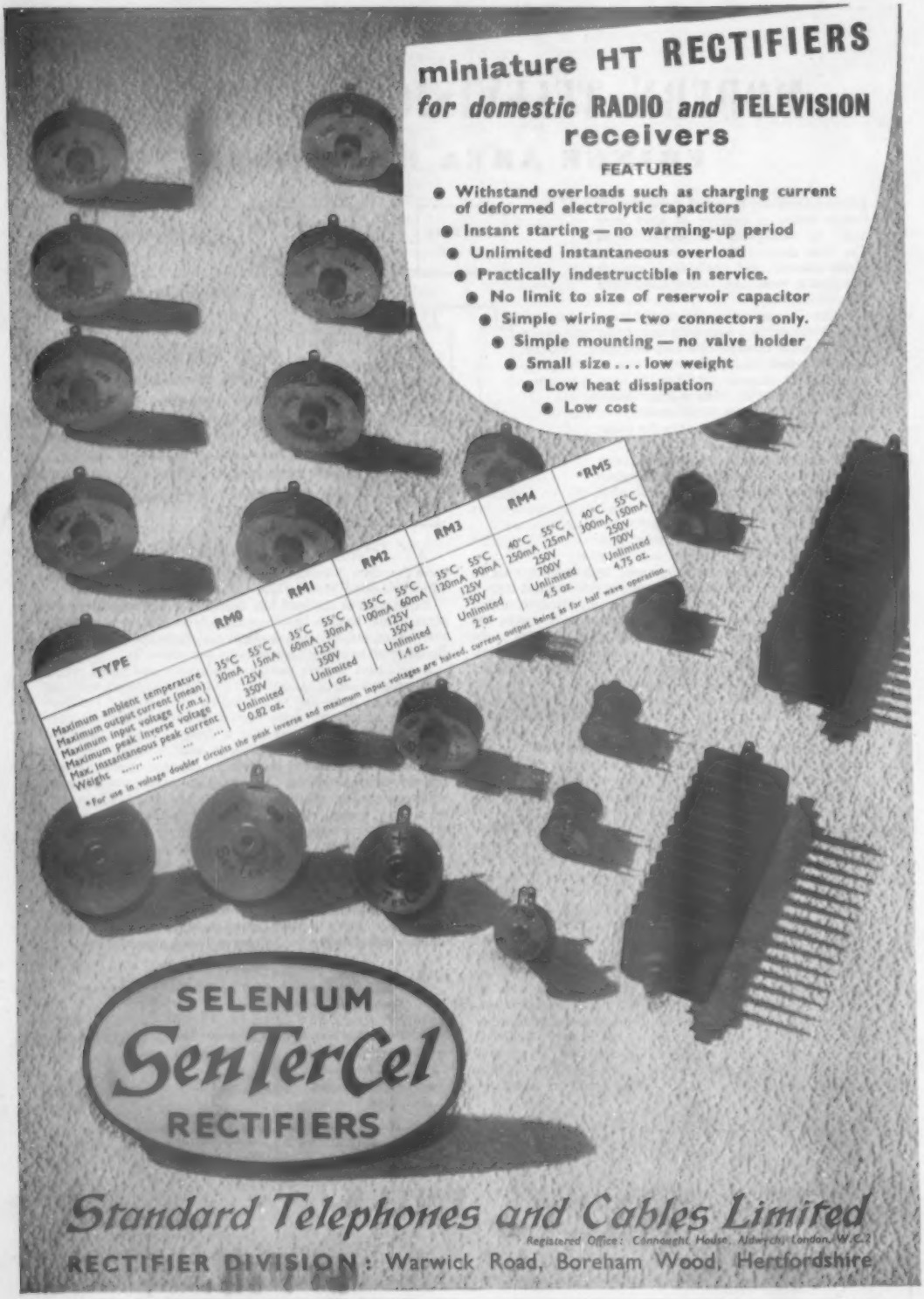
The specification of the "His Master's Voice" Fringe Area Model 1828 (given in brief below) incorporates all the essential and desirable fringe features outlined above.

SPECIFICATION

Vision Sensitivity for full modulation 5 micro-volts
Sound Sensitivity 1 micro-volt.
I.F. Bandwidth 3 Mc/s.
Impulsive Interference Inverter.
Long Time constant flywheel scanning.
AGC on sound.
AGC on vision.

"HIS MASTER'S VOICE"

THE GRAMOPHONE COMPANY LIMITED · HAYES · MIDDLESEX


miniature HT RECTIFIERS
for domestic RADIO and TELEVISION receivers
FEATURES
● Withstand overloads such as charging current of deformed electrolytic capacitors
● Instant starting — no warming-up period
● Unlimited instantaneous overload
● Practically indestructible in service.
● No limit to size of reservoir capacitor
● Simple wiring — two connectors only.
● Simple mounting — no valve holder
● Small size . . . low weight
● Low heat dissipation
● Low cost
TYPE
RM0
RM1
RM2
RM3
RM4
*RM5
Maximum ambient temperature
Maximum output current (mean)
Maximum input voltage (r.m.s.)
Maximum peak inverse voltage
Max. instantaneous peak current
Weight ....
35°C 55°C
30mA 15mA
125V
350V
Unlimited
0.82 oz.
35°C 55°C
60mA 30mA
125V
350V
Unlimited
1 oz.
35°C 55°C
100mA 60mA
125V
350V
Unlimited
1.4 oz.
35°C 55°C
120mA 90mA
125V
350V
Unlimited
2 oz.
40°C 55°C
250mA 125mA
250V
700V
Unlimited
4.5 oz.
40°C 55°C
300mA 150mA
250V
700V
Unlimited
4.75 oz.
*For use in voltage doubler circuits the peak inverse and maximum input voltages are halved, current output being as for half wave operation.
SELENIUM
SenTerCel
RECTIFIERS
Standard Telephones and Cables Limited
Registered Office: Connaught House, Aldwych, London, W.C.2
RECTIFIER DIVISION: Warwick Road, Boreham Wood, Hertfordshire

Piezoelectric Crystals

Survey of Physical Properties and Their Practical Exploitation

(*Concluded from page 280 of the previous issue*)

By S. KELLY*

THE analogue of the crystal transducer is shown in Fig. 9, in which C_e is the electrical capacitance, C_m is the effective compliance, M is the effective mass and 1:N is the "transformer" converting electrical to mechanical energy and vice versa. The capacity presented to the electrical terminals, the compliance C_m, and M, will all be a function of the mounting of the crystal, together with any mechanical appendages such as stylus, reed, etc. The "mechanical" terminals are open-circuited when the crystal is clamped (zero velocity) and short-circuited when completely free: under working conditions some form of complex impedance will normally be connected to them. In these analogues the following relations hold:—

Electrical	*Mechanical*
E.m.f.	Force
Current	Velocity
Inductance	Mass
Capacitance	Compliance

Although crystals are anisotropic, when one is investigating a particular cut it is admissible to treat the crystal constants as isotropic using the values obtained experimentally for that particular cut.

In the elementary theory of elasticity the three elastic constants of an isotropic solid are Young's modulus Y, the rigidity or shear modulus n, and the bulk modulus or volume elasticity E. Any one of the three can be expressed in terms of the other two by the relations given below, which also involves Poisson's ratio σ:

$$Y = 2n(1+\sigma) \quad .. \quad .. \quad .. \quad .. \quad (1a)$$

$$n = \frac{Y}{2(1+\sigma)} \quad .. \quad .. \quad .. \quad .. \quad (1b)$$

$$E = \frac{Y}{3(1+2\sigma)} \quad .. \quad .. \quad .. \quad .. \quad (1c)$$

$$\sigma = \frac{Y-2n}{2n} \quad .. \quad .. \quad .. \quad .. \quad (1d)$$

These various factors all enter into the mechanical design equations of the working transducer, and to obtain some insight into their application we shall consider one or two hypothetical examples.

The maximum displacement of a gramophone record groove is of the order of 0.01 cm. Assume for the sake of argument a crystal expander plate of 1 cm × 0.5 cm × 0.07 cm, which is a normal size for crystals used in pickups, the Young's modulus being 2×10^{11}. The crystal (Fig. 10) is firmly fixed at one end and is driven by the stylus at the other. At low frequencies where compliance is dominant the minimum playing weight necessary to keep the stylus in the groove when driven in compression and tension, (1) in Fig. 10, would be:—

$$W = \frac{D}{981.C_m} \quad .. \quad .. \quad .. \quad .. \quad (2)$$

where W = playing weight, D = displacement of stylus in cm, C_m = compliance in cm/dyne.

The compliance of the crystal as an expander is:—

$$C_m = \frac{l}{Y.w.t} \quad .. \quad .. \quad .. \quad .. \quad (3)$$

where Y = Young's modulus, l = length in cm, t = thickness in cm, w = width in cm.

From (2) and (3):—

$$W = \frac{D.Y.w.t}{981.l}$$

$$= \frac{10^{-2} \times 2 \times 10^{11} \times 0.5 \times 0.07}{981 \times 1}$$

$$= 7.14 \times 10^4 \text{ gm (71.4 kilograms).}$$

This value is somewhat high even for pre-war crystal

*Cosmocord Ltd.

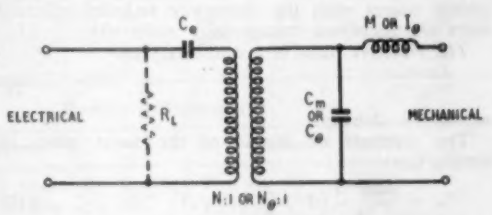


Fig. 9. Analogue of electro-mechanical relations in a crystal transducer.

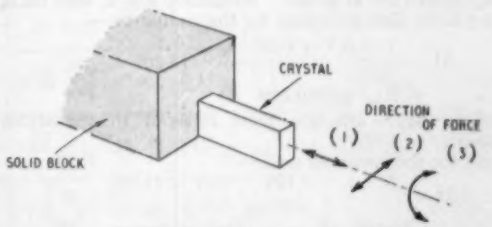


Fig. 10. Elementary crystal transducer illustrating the modes of applying stress open to the pickup designer: (1) compression, (2) cantilever, (3) torsion.

pickups! Let us therefore use the crystal as a cantilever, Fig. 10 (2), in which the direction of vibration will be at right-angles to the case cited above.

The compliance C_m of the crystal as a cantilever is:—

$$C_m = \frac{4l^3}{Y.w.t^3} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (5)$$

$$\text{and } W = \frac{D.Y.w.t^3}{4l^3.981} \quad .. \quad .. \quad .. \quad .. \quad (6)$$

$$= \frac{10^{-3} \times 2 \times 10^{11} \times 0.5 \times 0.343 \times 10^{-3}}{4 \times 1 \times 981}$$

$$= 82.5 \text{ gm.}$$

This value is still much too high for modern pickups, but is within striking distance of the optimum and represents about the average for pre-war pickups. The third alternative is to use the crystal in torsion (Fig. 10 (C)), by supporting the front end in a bearing and using a stylus, say, 1 cm long.

$$C_\theta = \frac{3l}{n.w.t^3\left(1 - 0.63\frac{t}{w}\right)} \quad .. \quad .. \quad (7)$$

where n is the modulus of rigidity and is obtained from equation (1b).

The assumption of a Poisson's ratio of 0.1 results in a rigidity modulus of 9.1×10^{10}, and

$$W = \frac{D.n.w.t^3\left(1 - 0.63\frac{t}{w}\right)}{3l.981} \quad .. \quad .. \quad (8)$$

$$= \frac{10^{-3} \times 9.1 \times 10^{10} \times 0.343 \times 10^{-3} \times (0.91)}{3 \times 1 \times 981}$$

$$= 48 \text{ gm.}$$

This is somewhat better and in actual practice the extra compliance required for a practical pickup would be obtained by using an elastic type of material for a support (such as rubber or p.v.c.) together with a cantilever stylus. At the high-frequency end of the band, mass impedance rather than compliance is the controlling factor and this is where the torsional crystal scores with the materially reduced effective mass and increased voltage/force sensitivity.

The effective mass of a cantilever is:—

$$\frac{l.w.t.\rho}{3} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (9)$$

where ρ = density.

The moment of inertia of the same plate in torsion is:—

$$I_\theta = \frac{\rho.l.w^3.t}{36}\left(1 + \frac{t^2}{w^2}\right) \quad .. \quad .. \quad .. \quad (10)$$

If a stylus of 1 cm length is used the effective mass at the stylus tip will be the numerical value given by equation (10) in grams. Assuming $\rho = 2$, and using the same sizes as before for the cantilever:—

$$M_e = \frac{1 \times 0.5 \times 0.07}{36} = 0.0233 \text{ gm}$$

$$= 23.3 \text{ milligrams}$$

where M_e = effective mass referred to the stylus point,

and for the torsional unit:—

$$M_e = \frac{2 \times 1 \times 0.125 \times 0.07 \times (1.02)}{36}$$

$$= 0.000495 \text{ gm} = 0.495 \text{ milligram.}$$

In other words, a greatly reduced effective mass compared to the cantilever crystal.

Practical crystals of the cantilever or torsional type consist of two correctly oriented plates cemented together with electrodes, connecting leads, and some form of protective coating, and are usually named "bimorphs." These units then behave as a homogeneous whole and the foregoing philosophy can be successfully applied.

It is now standard practice to specify crystal constants in M.K.S. units, and these can easily be converted to c.g.s. units if one remembers that the M.K.S. unit of force is the newton and is equal to 10^5 dynes; the accompanying table gives multiplying factors for both systems. Because most engineers still use the foot rule (and the majority of machine tools in this country are calibrated in inches) the physical dimensions of the crystals listed in Table 2 are given in inches and the other parameters are in the standard electrical nomenclature.

Table 2 shows the various constants of the equivalent circuit shown in Fig. 9. It should be noted that the torsional coupling coefficient is given in volts/newton.metre or volts/dyne.cm. The torsional compliance is given in radians/newton.metre or radians/dyne.cm. The effective moment of inertia is given in kgm.m^2 or gm.cm.^{2}.

Practical crystal stoday are usually between 0.5in and 1in long, 0.25in to 0.375in wide and 0.015in to 0.06in thick. In the case of barium titanate the length varies between 0.5in and 1in, width 0.06in to 0.1in and the thickness is usually 0.03in. Because of the low transducer ratio (N) and very high dielectric constant of barium titanate, the two elements are usually connected in series, giving twice the output voltage for a quarter of the parallel capacity. In the case of Rochelle salt units, where the reverse conditions hold, the parallel connections are used. The nominal value of capacity is usually set at a minimum 1,000 pF. In each case the compliance of the crystal is of the order of 10 times lower than that required for present-day pickups. The additional compliance is obtained by supporting the crystal on resilient rubber pads or using some other form of compliant coupling.

The resonant frequency of the system can be obtained from:—

$$f_r = \frac{1}{2\pi\sqrt{M.C_m}}$$

where M is the effective mass, or the moment of inertia, and C_m is the effective compliance.

From the values given in Table 2, it will be seen that the resonant frequency for bimorphs of identical size will be lower for cantilever units than for torsional units and the effective transducer ratio is also lower. It is important to use either M.K.S. or c.g.s. units throughout otherwise the resonant frequency of a pickup may appear to be in the megacycle band! If we compare a Rochelle salt bimorph of 0.5in × 0.25in × 0.03in a torsional and a bender unit, together with a barium titanate bimorph 0.7in × 0.1in × 0.03in (these are the normal sizes commercially available today) the following results are obtained:—

Rochelle salt
(Torsional parallel)

$C = 1.25 \times 10^{-9}$ farad
$N_\theta = 2.93 \times 10^4$ volt/newton.metre
$C_\theta = 1.3$ radians/newton.metre
$I_\theta = 1.64 \times 10^{-10}$ kgm.metre
$f_r = 11{,}000$ c/s.

Rochelle salt
(Cantilever parallel) $C = 1.25 \times 10^{-9}$ farad
$N = 2.0 \times 10^{2}$ volt/newton
$C_m = 1.3 \times 10^{-4}$ metre/newton
$M = 25 \times 10^{-6}$ kgm
$f_r = 2{,}800$ c/s.

Ceramic
(Cantilever series) $C = 7.6 \times 10^{-10}$ farad
$N = 63$ volt/newton
$C_m = 2 \times 10^{-4}$ metre/newton
$M = 52.5 \times 10^{-6}$ kgm
$f_r = 1{,}550$ c/s.

To bring these values down to the familiar c.g.s. units and assuming a stylus length of 1 cm for the torsional unit (a normal practical value), we get the following:—

	C ($\mu\mu$F)	N (mV/dyne)	C_m (cm/dyne) $\times 10^{-6}$	M (mgm)	f_r (kc/s)
Rochelle salt (Parallel torsional)	1250	2.93	0.13	1.64	11.0
Rochelle salt (Parallel cantilever)	1250	2.0	0.13	25.0	2.8
Barium titanate (Cantilever)	760	0.63	0.20	52.5	1.55

It will be seen that a torsional unit of the same size and material gives a superior performance for both the voltage sensitivity and resonant frequency, and that the sensitivity of the ceramic element is considerably lower than either of the two Rochelle salt units. The sensitivity of the titanate can be improved by decreasing the thickness, width, or increasing the length; the thickness of 0.03in is the present commercial minimum, this value being dictated by fragility in handling, warping during firing, etc. Increasing the length will decrease the resonant frequency and decreasing the width will reduce the capacity (but will not affect the resonant frequency) although the compliance will be inversely proportional to it. The same remarks in general apply to Rochelle salt, except that the minimum commercial thickness is 0.015in and the minimum width is about 0.2in, but in view of the higher coupling coefficient more liberties may be taken with the Rochelle salt than with the titanate.

Conclusions.—Of the three possible sources of transducer material at present available, A.D.P can be counted out for most pickup applications by virtue of the extremely low dielectric constant, although it is used to some extent for microphones. Rochelle

TABLE 2.
(Dimensions of crystals in inches)

			Twister "Bimorph"							
			Linear Three-Corner				Torsional			
	C_e Parallel	C_e Series	N Parallel	N Series	C_m	M	N_θ Parallel	N_θ Series	C_θ	I_θ
M.K.S. Multiply figures by	Farads 10^{-12}	Farads 10^{-12}	1	1	10^{-9}	kgm 10^{-3}	10^{2}	10^{2}	10^{-6}	10^{-6}
c.g.s. Multiply figures by	$\mu\mu$F 1	$\mu\mu$F 1	10^{-5}	10^{-5}	10^{-12}	gm 1	10^{-5}	10^{-5}	10^{-13}	1
Rochelle salt (30°C)	$300\frac{lw}{t}$	$75\frac{lw}{t}$	$\frac{5.65}{t}$	$\frac{11.3}{t}$	$11.3\frac{lw}{t^3}$	$4.28lwt$	$\frac{2.2}{wt}$	$\frac{4.4}{wt}$	$17.5\frac{l}{wt^3}$	$6.98\,lw^3t$
A.D.P.	$12.9\frac{lw}{t}$	$3.23\frac{lw}{t}$	$\frac{9\,9}{t}$	$\frac{19.7}{t}$	$17.5\frac{lw}{t^3}$	$3.74\,lwt$	$\frac{3.9}{wt}$	$\frac{7\,8}{wt}$	$27.1\frac{l}{wt^3}$	$6.05\,lw^3t$

			Bender "Bimorph"							
			Cantilever				Centre Drive			
	C_e Parallel	C_e Series	N Parallel	N Series	C_m	M	N Parallel	N Series	C_m	M
M.K.S. Multiply figures by	Farads 10^{-12}	Farads 10^{-12}	1	1	10^{-9}	kgm 10^{-3}	1	1	10^{-9}	kgm 10^{-3}
c.g.s. Multiply figures by	$\mu\mu$F 1	$\mu\mu$F 1	10^{-5}	10^{-5}	10^{-12}	gm 1	10^{-5}	10^{-5}	10^{-12}	gm 1
Rochelle salt (30°C)	$300\frac{lw}{t}$	$75\frac{lw}{t}$	$2.9\frac{l}{wt}$	$5.8\frac{l}{wt}$	$7.04\frac{l^3}{wt^3}$	$6.68\,lwt$	$0.73\frac{l}{wt}$	$1.45\frac{l}{wt}$	$0\,44\frac{l^3}{wt^3}$	$13.35\,lwt$
A.D.P.	$12.9\frac{lw}{t}$	$3.23\frac{lw}{t}$	$6.0\frac{l}{wt}$	$12.0\frac{l}{wt}$	$7.84\frac{l^3}{wt}$	$7.15\,lwt$	$1.5\frac{l}{wt}$	$3.0\frac{l}{wt}$	$0.49\frac{l^3}{wt^3}$	$14.3\,lwt$
Ceramic	$1300\frac{lw}{t}$	$325\frac{lw}{t}$	$0.135\frac{l}{wt}$	$0.27\frac{l}{wt}$	$1.6\frac{l^3}{wt^3}$	$25\,lwt$	$0.034\frac{l}{wt}$	$0.068\frac{l}{wt}$	$0.1\frac{l^3}{wt^3}$	$50\,lwt$

salt, when correctly used, can result in highly efficient, consistent and cheap mass-produced gramophone pickups. It should not be used at temperatures above 45°C and it must not be subjected to temperatures in excess of 55°C. In general, it is wise not to use Rochelle salt units within ± 20 degrees of latitude of the equator.

Barium titanate units have the advantage over Rochelle salt that they can be made completely tropical proof, although due allowance must be made for possible variation in sensitivity with temperature on zirconium-loaded elements. The capacity is virtually independent of temperature, but the voltage sensitivity is about − 20 db compared with Rochelle salt for the same needle-tip compliance. Because of the cantilever construction, the effective mass is considerably greater than that of a torsional unit, and if the needle tip impedance is to be kept within reasonable values at high frequencies some form of mechanical decoupling must be introduced between the stylus and the crystal element, and considerable high-frequency attenuation must be expected in the pickup.

From the foregoing it will be appreciated that the final solution of a particular pickup design problem is governed by many factors, and at present there is no one ideal solution for a crystal cartridge with a wide frequency range, of high compliance, which is completely tropical proof and has a high sensitivity; although each new development and improvement in technique brings the goal appreciably nearer.

Acknowledgment is made to Mr. A. C. Dobelli, of the Brush Crystal Co. Ltd., for information on fundamental crystal parameters.

Congress on Sound Recording—Paris 1954

Some Points from the Discussions and Items of Interest in the Exhibition

By H. J. HOULGATE, A.M.I.E.E.

FROM April 5th to 10th, 1954, an International Congress on Sound Recording was held in Paris. It was organized by the Société des Radioélectriciens, under the direction of G. Rabuteau, the President of the Society.

During the week of the Congress some 64 papers were read, and six visits to technical or industrial organizations were arranged.

An exhibition of everything appertaining to recording was open for the whole week, including Sunday, April 11th. In addition to this very full programme, evening engagements included a symphony concert, and a demonstration of synthetic music (including "Musique Concrete") arranged by Radiodiffusion-Télévision Française (R.T.F.).

The Congress was opened at a ceremony at which speeches were made by the President and by the distinguished physicist Louis de Broglie.

Technical Papers

The papers covered the whole field of the art and science of recording and were divided into five sections. Section 1 covered the history of recording, common problems, and measurements. Section 2 dealt entirely with magnetic recording and reproduction, including its future application in the television field. Recording for the cinema in all its aspects was dealt with in Section 3, whilst Section 4 was devoted to disc recording including the special problems of microgroove and factory production of gramophone records. Section 5 included papers on many applications of recording in industry and science, covering the recording and storage of pulses, cathode-ray memory systems, long-duration data recording, and the generation of synthetic music.

An account of the measurement of "wow" and "flutter" and its subjective effect, by M. Caciotti, of the Italian Broadcasting Organization, was read by his colleague Signorina Bordone. For testing magnetic recorders having had very little speed fluctuation, the following method was suggested. A continuous loop of tape, lasting some seconds, is used, and the output of the machine is connected to its input after the loop has been recorded with tone. Each "pass" of the loop through the machine then reproduces and re-records the tone, a process which results in an increase in the "wow" content of the recording. It was shown that if the "wow" and "flutter" are of a random nature, as is often the case in first-class machines, then the final speed fluctuation is equal to $h\sqrt{n}$, where h is the original fluctuation and n is the number of dubbings. Such a method is also applicable to measurements on disc recorders. Subjective tests led to the statement that speed fluctuations at the rate of 15 per second were the most objectionable to the ear. Reference was also made to the fact that the frictional forces on the tape can result in longitudinal vibrations, which in their turn give rise to frequency modulation of the recorded signal. This effect produces high-frequency flutter, which although at much too high a rate to be noticed as a variation in pitch, results in the generation of objectionable sidebands.

F. Gallet, an engineer on the staff of R.T.F., discussed in detail the causes of noise in magnetic recording systems. He gave the signal/noise ratio for a typical machine as 50 db when measured by a "flat" voltmeter, and 65 db if an aural simulation network were used. It was pointed out that, although these figures were acceptable for a recording system, an amplifier to be used in a broadcasting chain would have a much better signal/noise ratio, and that every effort

should be made to improve the performance of magnetic recorders in this respect. Some considerable attention was given to modulation noise, which was shown to be due to two distinct causes. The variations in the magnetic properties of the tape and the imperfect contact it made with the head resulted in amplitude modulation of the programme by signals of a random nature, whilst longitudinal vibration of the tape gave rise to frequency modulation of the programme, the modulation being in general random, but being "coloured" by the natural longitudinal resonance of the tape in the region of the heads. Such a frequency modulation causes the noise spectrum accompanying a tone to include sidebands. It is, of course, desirable to give a measure in terms of signal/noise ratio to the modulation noise. This is not easy to do since the noise is always accompanied by the signal, which is of much higher amplitude, and must be removed, together with its harmonics, by very sharp filters. It was shown, however, that the spectrum produced by amplitude modulation of the signal was independent of the signal frequency, and so could be measured using a signal of zero frequency, i.e., d.c. Such a measurement is not all that could be desired, but it is of use in assessing the properties of the tape, since the components which are ignored by this method are those due to frequency modulation and these are as much a function of the recorder as of the tape itself.

Testing Magnetic Tape

A second paper by F. Gallet was devoted to the problems involved in testing tape received from the manufacturers. He described a machine for testing nine tapes at once, which was on show in the exhibition. It consisted of nine channels of recording and reproducing heads together with feed and take-up spools, and a common capstan shaft, driven by motors on the bedplate of the machine. Each of the nine tapes was tested for sensitivity at 800 c/s throughout its length under standardized conditions. The output from each tape was recorded by a recording voltmeter on a strip of paper about 10in long. In addition to the sensitivity tests, two of the tapes on the machine were given a modulation noise test and the resulting noise output was recorded on further charts.

It is well known that in the manufacture of recording tape the support material is coated with the oxide in fairly large widths, and each batch is subsequently slit into the ¼in tape used on the machines. The lecturer stated that it was desirable that more stringent tests be performed on at least one tape from each batch. Special equipment is therefore used to plot graphs of frequency response, output *v.* bias, distortion *v.* output, and, after a 24-hour delay, to record the "print" level. All these tests are recorded on one strip of paper, which, in common with the sheet recording sensitivity, carries a code number identifying the tape completely, both as to batch, and the position the particular tape occupied in the original wide sheet. This equipment is of particular interest, since a controlling amplifier connected between the output of the system and the input to the recorder is used to keep the output of the system constant. The actual output from the reproducing amplifier is then determined by a variable attenuator connected between its output and the control point. Thus the signal applied to the harmonic analyser can be taken from the constant level control point and the recording meter has only to measure the harmonic output, and not, as would be more difficult, the harmonic to total signal ratio.

Maurice Soubrier had been concerned with the problem of correcting a recording, such as that on a magnetic dictating machine, either by the deletion of undesired matter or by the addition of new material. He described a method of doing this without cutting the tape, or re-dictating the matter coming after the additions. He proposed using two or more coupled recorders capable of recording or reproducing in either direction of travel of the tape, and so arranged that subject matter could be transferred from one tape to another at will. To save time the re-recording could be carried out whilst the machine was running backwards. An apparatus could certainly be made to do this, but the present writer fears that it would be rather complicated for office use, but might have applications in broadcasting when much editing is necessary.

Dr. Schiesser, of Rundfunk-Technisches Institute G.m.b.H., discussed the magnetic recorders and ancillary equipment which have been developed for use in the German Federal Broadcasting System. Of special interest was the small portable recorder, Type R85, which records at 7½in per sec. using 1,200ft spools. The motor system is fed by batteries. A separate reproducing head and amplifier are fitted for monitoring and subsequent reproduction, and the overall response was stated to be flat to 10 kc/s. The recorder measures approximately 10in × 15in × 5in and weighs 22lb. Dr. Schiesser referred amongst other things to the work done by N.W.D.R. on artificial reverberation, and mentioned work of a similar nature which had already been carried out by Dr. Axon at the B.B.C. Research Department.

Recording Television Signals

One afternoon was devoted to the application of the magnetic system to television recording. J. T. Mullin, of Bing Crosby Enterprises, described the multi-track system developed by his company, and Commander C. G. Mayer gave an account of the system developed by R.C.A. This latter system uses ½in-wide tape to record both sound and colour television signals and is capable of recording black and white television and sound on normal ¼in-wide tape. The tape speed is about 30ft per sec and special measures are taken to maintain the tape tension constant at all times. Commander Mayer pointed out that the speed constancy requirements were extremely stringent for this work and stated that constancy in excess of 1 part in 10^5 was needed. The recording and reproducing heads present unusual problems, since the recorded wavelength at 4 Mc/s is only about 2½ microns. A further trouble occurs in the sound channel and indeed at the l.f. end of the video channel, because the tape speed is so high that the wavelength becomes large compared with the head dimensions and results in a low-frequency loss in addition to that normally encountered in the magnetic system.

J. Borne, of the Laboratories d'Electronique de Physique Appliquée, discussed the influence of the physical and magnetic characteristic of the recording head upon the response at high frequencies, whilst his colleague, J. Perilhou, discussed, in addition, some of the mechanical problems involved. He endorsed the statement already made by others, that separating a reproducing head from the tape by one wavelength results in 55 db loss of output.

The last item on the afternoon's agenda was a demonstration by Prof. Boutry, from the Conservatoire National des Arts et Métiers, of television recording on a magnetically coated drum. The programme radiated by R.T.F. was recorded, immediately reproduced, and shown on a projection receiver screen. The bandwidth in use was only about one megacycle, so the results were not perfect, but for most people present it was the first time they had seen such a demonstration. It was stated that the clearance between the heads and the drum, necessary to eliminate wear, was about 0.00004in. Such a fine clearance necessitated great precision in the drum bearings.

Several papers were devoted to the use of magnetic recording as a memory for calculating machines. One interesting application was that of recording teleprinter signals. It was stated that one character could be recorded, on a multi-track system, in 0.0005in length of tape. Thus much more information could be stored in a given space with the magnetic system than was possible on the normal perforated paper tape. In fact a foot or two of tape could contain the equivalent of many pages of typescript.

In the section on disc recording an interesting paper was read by P. Meunier, of R.T.F. He and his colleagues have been concerned at the difficulty of cutting microgrooves on lacquer recording blanks. He has noted that the degree of flatness required for this purpose is very high, and showed that a re-design of the usual cutter head mounting is of considerable help. Briefly he established that the head must be pivoted so as to possess minimum inertia and minimum friction. The head, with a minimum of added mass, is mounted on a pivoted arm with no counterbalance. A second arm, separately pivoted, projects beyond the pivots and carries a counterbalance weight. It is coupled to the head by a spring and dashpot system. In the published paper* the simplified equivalent electrical circuits of the mechanical system are analysed. Considerable improvement was claimed, not only in the reduction of effects due to lack of disc flatness, but also in those caused by motor vibrations.

Exhibition

As might be expected, a large proportion of the forty-nine exhibitors were showing magnetic recorders of one type or another. Studio machines were represented by E.M.I. of England, Tolana and Bordereau of France, A.E.G. and Vollmer of Germany, and Ampex of U.S.A. Some of these machines were provided with push-button operated shears to cut the tape adjacent to the reproducing head when editing.

On the N.W.D.R. stand an interesting midget tape recorder made by Maihak was shown. It operated at 7½in per sec and would record for 7½ mins on one winding of its spring motor. The recording or reproducing amplifier was battery operated. The complete instrument was about 9½in × 12½in × 4½in in size, and weighed 16lb. It was stated that a second head could be fitted to record timing signals from a film camera so that the tape could subsequently be synchronized with the film. In another version of this recorder the spring motor gave a constant-speed drive for 12 minutes.

A somewhat larger and heavier battery and spring-operated recorder was shown by Acémaphone.

Another spring-driven recorder was shown by Rocke International on behalf of the Amplifier Corporation of America. Called the "Magnemite," it was available with tape speeds ranging from 1⅛in per sec to 15in per sec. The slow-speed machine was stated to record from 200 to 2,500 c/s and to run for 30 minutes on one winding. An unusual feature of some of these models was an external flywheel mounted on top of the capstan. The smallest and lightest of the range, operating at 1⅞in per sec, was 11in × 8in × 5in in size and weighed 10lb. A portable battery-driven recorder intended for professional use and of similar dimensions and weight to the above instruments is available from E.M.I.

Domestic tape recorders were on many stands, but only two will be referred to. The A.E.G. model KL25 operates at 3¾in per sec and has a counter operated by one spool to facilitate "place finding." A response to 10 kc/s was claimed and a separate reproducing head and amplifier is included.

Radio Star were showing a very small domestic recorder, including amplifier and oscillator, which could be stood complete on any turntable or clockwork gramophone to provide the tape drive. The amplifier would function on a.c. or d.c. mains.

A device of great interest to film enthusiasts was a stabilized, film-pulled, magnetic sound attachment which could be mounted between the arm carrying the feed spool and the body of almost any projector. The unit, which is reminiscent of some of the units fitted to professional projectors for stereophonic sound in cinemas, is marketed by Fred. Jeannot.

One of those things which had to be produced sooner or later was a simple but satisfactory clip for holding the free end of a reel of tape firmly to one cheek of the spool. It is made by H. Gravillon, Paris.

A machine for making welded joints in p.v.c. tape was being demonstrated by Sonocolor. A joint could be made in about 10 seconds, including trimming the ends of the tape and loading and unloading the machine.

Two gramophone turntable units are worthy of mention. Thorens of Switzerland were showing a three-speed motor, governor controlled, which used a gear change to go from 78 to 33⅓ r.p.m. 45 r.p.m. was obtained by using the governor. Thus all three speeds were adjustable. The pickup fitted to the model on show was an American G.E. variable reluctance unit, which could be lowered by push-button at any of the three usual record diameters.

A high-grade, three-speed, 17in diameter turntable was being exhibited and demonstrated by E.M.T. of Germany. This incorporated many refinements, including an optical device for locating the pickup on the disc and a remotely controlled rapidly starting turntable.

A most unusual-looking loudspeaker was exhibited by Elipson and was used in the demonstrations of "Musique Concrete." The unit is conventional, but the enclosure appears to be cast in plaster and is ported in the normal way. Over the cone, which faces upwards, is a large, shell-like elliptical reflector, also of plaster, which gives the unit its name—"La Conque." The reflector is so placed that the loudspeaker unit is at one focus of the ellipse, and hence an image source appears at the second focus. The result is claimed to be a uniform sound distribution over a fairly wide angle down to 800 c/s, but outside this angle the sound is attenuated and hence undesirable building echoes are not excited.

* The original text (in French) of some of the papers read at the Congress, and a summary of others, can be consulted in the March 1954 issue of *L'Onde Electrique* (Vol. 34, No. 324).

NEW! EXPERIMENTAL OUTFITS

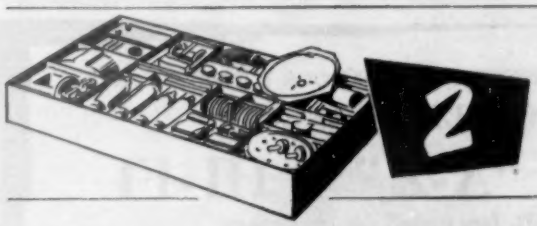
LEARN THE PRACTICAL WAY

Specially prepared sets of radio parts with which we teach you, in your own home, the working of fundamental electronic circuits and bring you easily to the point when you can construct and service radio sets. Whether you are a student for an examination; starting a new hobby; intent upon a career in industry; or running your own business—these Practical Courses are intended for YOU—and may be yours at very moderate cost.

EASY TERMS FROM £1 A MONTH

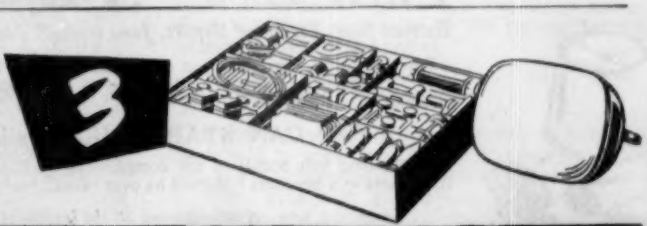
With these outfits, which you receive upon enrolment, you are instructed how to build basic Electronic Circuits (Amplifiers, Oscillators, Power Units, etc.) leading to complete Radio and Television Receiver Testing and Servicing.

RADIO Outfit No. 1.—For carrying out basic practical work in Radio and Electronics, from first principles and leading to the design and building of simple Receivers.



RADIO Outfit No. 2.—With this equipment, you are instructed in the design construction, testing and servicing of a complete modern Superhet Radio Receiver.

TELEVISION Outfit No. 3.—With this equipment you are instructed in the design, construction, servicing and testing of a modern high-quality Television Receiver.



OTHER COURSES WITH EQUIPMENT INCLUDE:

MECHANICS · ELECTRICITY
CHEMISTRY · PHOTOGRAPHY
CARPENTRY

ALSO DRAUGHTSMANSHIP · COMMERCIAL ART
AMATEUR S.W. RADIO · LANGUAGES · ETC.

POST THIS COUPON TODAY

Please send me your FREE book on Practical Courses; I am interested in Radio 1 ☐, Radio 2 ☐, Television ☐.

Other subjects.....

To: E.M.I. INSTITUTES, Dept. 127x, 43, Grove Park Road, Chiswick, London, W.4.

NAME .....

ADDRESS .....

.....

7/54

E.M.I. INSTITUTES The only Postal College which is part of a world-wide Industrial Organisation

IC.31

WESTON ELECTRICAL INSTRUMENTS INCLUDE :—

LABORATORY STANDARDS · SUB STANDARDS · FIRST GRADE PORTABLE INSTRUMENTS · ROUND, RECTANGULAR AND EDGEWISE SWITCHBOARD AND PANEL INSTRUMENTS · PORTABLE TEST SETS · RELAYS · AIRCRAFT INSTRUMENTS

THE WESTON RANGE OF RECTANGULAR INSTRUMENTS

Supplied as D.C. moving coil, A.C. rectifier and H.F. thermocouple types ; also A.C./D.C. moving iron types. Four sizes are available with scale lengths of 2.5in., 3.2in., 4.2in. and 6.25in.

Front of panel or back of panel mounting may be adopted as desired, and if the former method is used there is complete interchangeability with existing round models. The 3.2in. and 4.2in. scale instruments are available with either illuminated or non-illuminated dials ; the 2.5in. and 6.25in. scale instruments being available only with non-illuminated dials.

WESTON
Measuring Instruments

SANGAMO WESTON LIMITED

Enfield, Middlesex. Tel: Enfield 3434 (6 lines) & 1242 (6 lines) Grams: Sanwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151.
Branches : London, CHAncery 4971 · Glasgow, Central 6208 · Manchester, Central 7904 · Newcastle-on-Tyne, Newcastle 26867 · Leeds, Leeds 30867 · Liverpool, Central 0230 · Wolverhampton, Wolverhampton 21912 Nottingham, Nottingham 42403 · Bristol, Bristol 21781 Southampton, Soton 3328 · Brighton, Brighton 28497

P. WILSON, M.A., of 'THE GRAMOPHONE' ENDORSES OUR FORMULA FOR

PERFECT LISTENING:

F.M. *PLUS* "A-Z" = HI-FI

Extract from Technical Report, June issue, "The Gramophone":

"For the future, therefore, you may count me as one of the fans of "F.M. via A-Z." I would not dream of listening to an ordinary transmission when this alternative is available."

YOU CAN START a Hi-Fi build-up with £20

May we send you details of the complete High Fidelity range of Radio Units, Amplifiers and Speakers? Backed by over twenty years enthusiasm and experience.

Available from all the leading Agents.

SOUND SALES LIMITED • WEST STREET • FARNHAM • SURREY

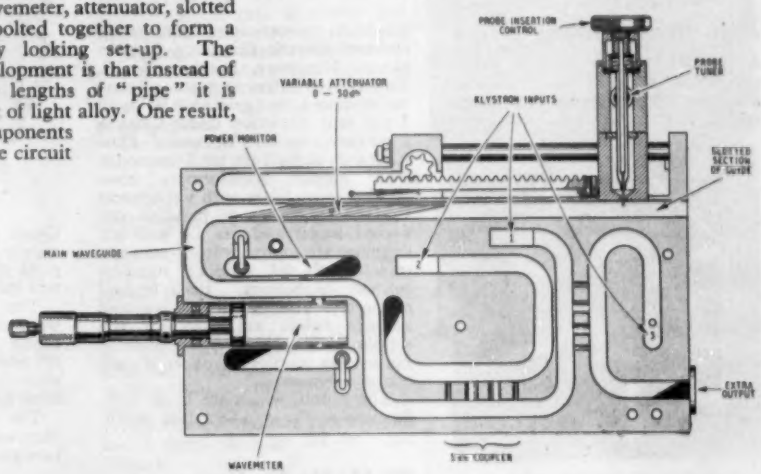
Telephone : Farnham 6461-2-3. *Telegrams : Sounsense, Farnham.*

Integrated Microwave Test Bench

Losses and Reflections Due to Imperfect Assembly Avoided

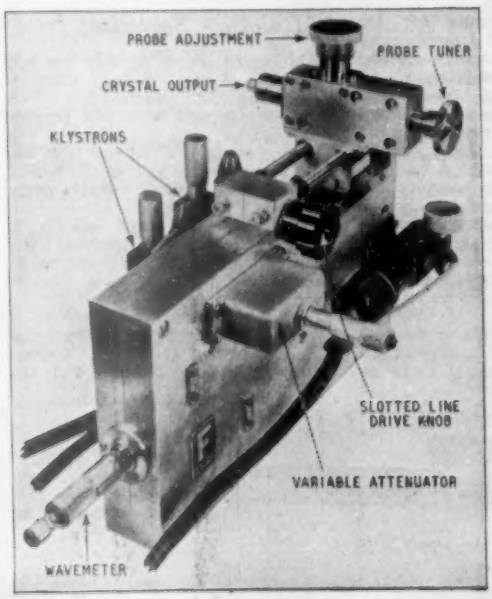
AN interesting and original exhibit at the recent R.E.C.M.F. show was the Ferranti X-Band Test Bench, referred to briefly in last month's report. It appears to be a distinct step forward in microwave technique.

Ordinarily, the outfit needed for microwave tests and measurements comprises a number of separate waveguide instruments—wavemeter, attenuator, slotted line, matched loads, etc.—bolted together to form a rather lengthy and untidy looking set-up. The essence of the Ferranti development is that instead of being built up of separate lengths of "pipe" it is milled out of one solid block of light alloy. One result, at least as regards the components thus "integrated," is that the circuit is fixed. This may be a disadvantage for general experimental purposes requiring flexibility of apparatus. But for carrying out standard tests it is an immense advantage to have equipment that can be relied upon to be always the same; that is to say, with no alterations or borrowing of essential parts by some other worker since one last used it. As there are no joints between sections of guide, there is no chance of variable losses and reflections due to imperfect assembly. The only joint is the one between the two halves of the block, and because this comes half-way along the major dimension of the rectangular guide section, it impedes no current.



Right: Section through the Ferranti X-Band Test Bench showing positions of the items mentioned in the text.

Below: The block of the unit provides a convenient mount for additional items of test equipment.



Manufacturing Advantages

The method of manufacture greatly reduces costs (it is said to take one-third of the time required to produce a conventional test bench); it makes possible a more consistent product; it facilitates internal inspection and accessibility; and because there is no question of the guide being deformed by its being taken around sharp bends the whole apparatus is very compact, as well as being cleaner in appearance, stronger, and more rigid. The block forms an adequate mount for additional components that may be required; amplifiers can be plugged directly into the waveguide, thereby avoiding the use of flexible leads.

Provision is made for any number up to three klystron oscillators; this is convenient for covering a wide frequency band or for testing at several spot frequencies without having to make readjustments.

The black areas in the drawing indicate matched terminations. From the klystrons the main waveguide leads in turn to:—

(a) a micrometer-controlled wavemeter, operating in the H_{113} mode,

(b) a crystal detector for monitoring the output power,

(c) a micrometer-controlled nichrome-film glass-vane attenuator with a range of 0-30 db, accurate to ±0.1 db, and

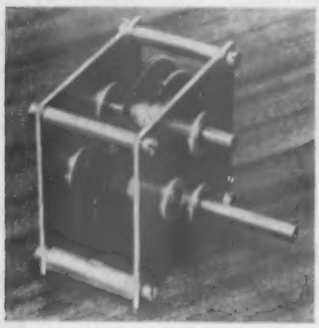
(d) the slotted line, with probe insertion controllable up to 2 mm, and longitudinal position variable over 90 mm to an accuracy of 0.02 mm, providing voltage standing-wave ratio discrimination down to 1.01. The frequency range of the whole unit is 9-10 kMc/s (3.00-3.33 cm wavelength).

Manufacturers' Products

NEW EQUIPMENT AND ACCESSORIES FOR RADIO AND ELECTRONICS

High-Ratio Tuning Drive

A GEARED drive with a reduction ratio of 56.25 to 1 intended primarily for bandspread or precision tuning over shortwave bands in a



Jackson high-ratio geared drive Type Gl.

receiver has been introduced by Jackson Bros., Kingsway, Waddon, Surrey.

It is fitted with spring-loaded gears and self-aligning ball bearings to ensure a smooth action free of backlash at all shaft loads up to 24 oz/in. Stops are included to prevent overdriving at the limits of rotation as a safeguard against damage to the gears.

High- and low-speed shafts (driving and driven respectively) project back and front of the casing, thus permitting the addition of a driving motor if required and providing facilities for a pointer or scale on the front extension of the capacitor shaft.

At present the drive is available to equipment makers only and without dial, knob or other accessories.

Industrial P.A. Amplifiers

POWER outputs up to 2.4 kW for large factories, railway stations and wire relay systems are provided by parallel connection of unit 100-watt amplifiers recently introduced by the General Electric Company, Magnet House, Kingsway, London, W.C.2. Two DA100 valves in push-pull may be operated to give 100 W with 3 per cent distortion under Class A conditions, or 175 W under Class AB2 with 6 per cent total harmonic. The output transformers have divided secondaries with impedances suitable for series or parallel connected loads, and the l.t. and h.t. supplies are derived from separate transformers to simplify stand-by running of heaters. Four bridge-connected directly heated vacuum rectifier valves are used for h.t. supply with a choke input smoothing system employing paper dielectric condensers.

The panels, which are 15¾in high, fit racks of the standard 19in width.

F. M. Feeder Unit

DESIGNED specifically for the B.B.C. experimental transmissions from Wrotham, this unit covers 87.5 to 100 Mc/s and comprises an r.f. stage, self-oscillating triode frequency changer, two i.f. amplifiers with a.v.c. to prevent overloading and to minimize aircraft flutter, and a ratio-type discriminator. A cathode-ray tuning indicator occupies the centre of the horizontal tuning dial.

The unit has been designed to have good frequency stability after the initial warming up period, and with a field strength of 3 mV/m gives an average of 40 mV audio output into 100 kΩ.

When required for use in conjunction with existing high-quality amplifiers, such as the Leak TL/10 or

Chapman FM81 feeder unit.

Quad I or II, appropriate power supply and output plugs can be supplied and suitable h.t. dropper resistors included in the set.

The price is £18 10s, and a half-wave dipole aerial with window sill fitting can be supplied for £1 18s 6d. If necessary a horizontal H aerial with 5ft chimney mast and fittings costs £4 15s 6d.

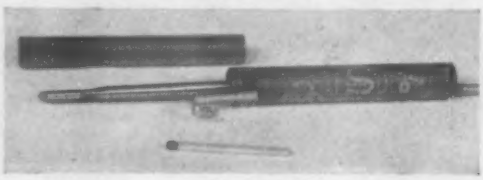
The makers are C. T. Chapman (Reproducers), Ltd., Riley Street, London, S.W.10.

Miniature Soldering Iron

AN overall length of only 6in and a weight of only ½ oz are features of a new miniature soldering iron which can be supplied with bits ranging in diameter from ⅛in to ¼in. The loading of the smallest size (⅛-in bit) is 12 watts, while that of the largest is 40 watts. Working voltages range from 6 to 250 V, a.c. or d.c.

Despite their small size it is claimed that the mains element irons can be left switched on while not in actual use for very long periods without coming to harm.

The "Litesold," as the iron is known, is made by Light Soldering Developments, Ltd., 106, George Street, Croydon, Surrey, and the



"Litesold" miniature soldering iron with replaceable bit and cover.

price is 19s 6d with a fixed ¼-in diameter bit and 21s 6d with a replaceable bit. A protecting cap for the bit and element is included.

Lilliput Lampholders

A RANGE of sub-miniature lampholders described as the Type LES (lilliput Edison screw) conforming to Section E of BS98 as regards lampholder dimensions, has been introduced by A. F. Bulgin and Company. They are available with fixing brackets of five different shapes; one is the baseboard model shown here in its actual size, while the others are shaped for securing to various types of scale and other devices for which illumination is required. Other types of bracket can be supplied by special arrangement.

Bulgin lilliput lampholder Type LES4 shown actual size.

The list price of each of the five normal types is 9d. The maker's address is Bye Pass Road, Barking, Essex.

Precision Potentiometer

WIRE-WOUND precision potentiometers with linear or graded windings, accurate to one part in 10^4 of a given law, are now obtainable from Salford Electrical Instruments. These find applications in radio compasses, altimeters, prediction and computor equipments as well as in many types of industrial electronic apparatus.

They are made with either toroidal or card windings of from 300 to 50,000 ohms resistance and with a normal rotation of 340 deg, but a full 360-deg movement can be supplied for special purposes.

In the toroidal types the windings range from 1 to 3½in in diameter and while these generally follow a linear law, slight deviations from the linear can be embodied in the winding if necessary.

The strip type, on the other hand, can be supplied with linear or non-linear windings and made to incorporate functions such as sine-cosine relationships, these being achieved by suitably shaping the winding card and fitting special wiper contacts.

Machines have been developed which will cut several cards at a time to an accuracy of $\frac{1}{10000}$ in of a

Special sine-cosine potentiometer made by Salford Electrical Instruments.

calculated shape, while other machines wind wire as fine as 0.0006in in the case of toroids and 0.0008in for strips.

Tappings are fitted wherever required by a brazing process specially developed to permit attachment of wires to within 0.5 deg of a calculated position.

The maker's address is Peel Works, Silk Street, Salford 3, Lancs.

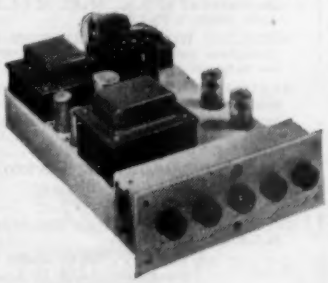
High-quality Amplifier

THE Type PF91 amplifier and remote control unit recently introduced by Pye, Cambridge, is designed for high-quality reproduction from gramophone records and radio. It incorporates four alternative equalizer circuits, to compensate for most recording and pickup characteristics in addition to continuously variable bass and treble tone controls and a steep-cut filter for 4, 7 and 12 kc/s.

The power output for less than 0.1 per cent distortion at 1 kc/s is stated to be 12 watts and hum and noise level −90 db relative to 15 watts.

An interesting feature of the design is the provision of adjustable positive feedback (in addition to the main negative feedback) in order that the effective output impedance may be reduced to zero to improve loudspeaker damping.

The price of the main amplifier (PF91) will be £29 8s and of the pre-amplifier (PF91A) £12 12s.



Pye Type FF91 amplifier and PF91A pre-amplifier and control unit.

Progress in SOUND

TRIX equipment maintains a long-established tradition of progressive design and high-grade workmanship. There are standard units for every requirement, each a masterly expression of sound-reproduction technique. For large or small installations, our catalogue and expert advice are freely at your disposal.

The NEW MODEL T621 AMPLIFIER

An economical general purpose amplifier designed for both AC and Battery operation with a simple plug-in adaptor unit, and providing 25 watts output, ample for most general Public Address uses.

Two inputs, for pick-up and microphone, low and high impedance, with mixing controls. Output connections for 8 and 15 ohm speakers, also high impedance 100 volt line.

Quality of reproduction is ensured by the incorporation of an adequate output transformer in the push-pull output stage with inverse feedback over 3 stages.

TRIX

The TRIX ELECTRICAL COMPANY LTD.

1-5 MAPLE PLACE, TOTTENHAM COURT ROAD, LONDON, W.1.

Telephone: MUSeum 5817

Telegrams and Cables: TRIXADIO WESDO LONDON.

RANDOM RADIATIONS

By "DIALLIST"

Peace, Perfect Peace

WHAT a joy it is to have two simultaneous f.m. transmissions from Wrotham on most days of the week. The programmes *certainly* come in free from interference of any kind. That, I'm afraid, is a lot more than can be said for the same programmes as transmitted on the medium or the long waves. With 90-Mc/s f.m., fading, sideband splash, heterodynes, atmospherics and re-radiated interference just don't happen. "Sporadic E" may, I suppose, have dire effects; but I've never experienced them. For some reason that I can't make out I've never yet been able to pick up any of the Continental f.m. broadcasts, though a good many other people have reported them. I should be pretty well placed too. My f.m. dipole is 550 feet above sea-level and it "points" almost straight at Paris. I've tried the 96-Mc/s neighbourhood time and again during the station's advertised working periods; but not a sniff of a signal can I get.

A Wonderful Chance

IT is reported that receivers for the frequency-modulated transmissions on Band II are to be a feature of this year's National Radio Show. I trust that they will include high-grade models, able to do full justice to the quality of these signals with their wide range of modulation frequencies. With a really good receiver, the quality of both speech and music is something of a revelation. To begin with, you have an absolutely silent background, which means that low sound levels in the transmission can be allowed to be really low. In fact, the volume contrasts when an orchestra is playing can be given their full value, with no need for "compression." And the designers of a.f. circuits and of loudspeakers can let themselves go, knowing that they are dealing with signals worthy of their best. For the first time since broadcasting began, genuine high-fidelity radio has become possible. Let's hope the manufacturers will rise to the occasion by producing receivers of the luxury class which are real musical instruments. Recalling, though, what the urge for "cheapness first" has done to the sound accompanying television in so many table model sets, one isn't too optimistic.

Simple—But it Works

IN the ordinary way I'm not fond of indoor TV aerials; they're too prone to pick up any interference that's going. Still, they come in handy at times. You may, for example, want for one reason or another to use the receiver in a room in which there is no connection to the outdoor aerial. Well, provided that you've an adequate signal, here's a cheap and simple way of rigging up an indoor dipole that will do the trick. The ingredients needed are a length of single flex, p.v.c. covered for choice; an old 4-pin valveholder; a suitable length of the right feeder for the set, with connector; and a pair of battery wander plugs. Cut two lengths of flex, using the formula $L = 231/f$ (Mc/s), where L is the length of each piece. Bare one end of each piece, fixing one to the grid terminal and the other to a filament terminal of the valveholder. Connect one wander plug to the inner, and the other to the outer, of the feeder, which we'll suppose to be co-axial cable. And that is practically that. To "erect" the aerial, drive a small nail into the picture rail and fasten the end of the flex connected to the filament terminal of the valveholder to it with a piece of string. Fix the valveholder to the wall so that this bit of flex is vertical. Run the other piece of flex along the wall at right-angles to the first and anchor to a nail as before. Stick the wander plug connected to the inner into the socket in the valveholder corresponding to the vertical leg of the dipole and t'other into that corresponding to the horizontal. I trust you'll find, as I do, that you get remarkably good results from this simple arrangement.

Proof by Nine

MY very best thanks to the army of readers in this country, on the Continent, in the U.S.A. and elsewhere who have sent (and are still sending) me proofs of the Proof by Nine. It appears that my vague recollection of "casting out the nines" rang the bell. There are many ways of proving the Proof by Nine algebraically: some readers did it in one page; some needed from two to ten pages before they could write Q.E.D. Various proofs appear in a number of published works on arithmetic, or on mathematical curiosities. The basic fact is that if you take any complete number of units, tens, hundreds, thousands . . . the initial digit gives the remainder when that number is divided by nine. Thus: $5 \div 9$, $R = 5$; $10 \div 9$,

ASSOCIATED ILIFFE TECHNICAL BOOKS

"WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
RADIO DESIGNER'S HANDBOOK. F. Langford-Smith, B.Sc., B.E., M.I.R.E., A.M.I.E.E., A.M.I.E. 4th Edition	42/-	43/6
INTRODUCTION TO VALVES. R. W. Hallows, M.A. (Cantab.), M.I.E.E., and H. E. Milward, B.Sc. (Lond.), A.M.I.E.E. ...	8/6	8/10
TELEVISION ENGINEERING: Principles and Practice. VOLUME ONE: Fundamentals, Camera Tubes, Television Optics, Electron Optics. A B.B.C. Engineering Training Manual. S. W. Amos, B.Sc.(Hons.), A.M.I.E.E., and D. C. Birkinshaw, M.B.E., M.A., M.I.E.E., in collaboration with J. L. Bliss, A.M.I.E.E.	30/-	30/8
WIRELESS WORLD TELEVISION RECEIVER MODEL II: Complete constructional details with notes on modernising the original design	3/6	3/9
RADIO INTERFERENCE SUPPRESSION as Applied to Radio and Television Reception. G. L. Stephens, A.M.I.E.E. ...	10/6	10/11
SOUND RECORDING AND REPRODUCTION. A B.B.C. Engineering Training Manual. J. W. Godfrey and S. W. Amos, B.Sc. (Hons.), A.M.I.E.E.	30/-	30/8
ADVANCED THEORY OF WAVEGUIDES. L. Lewin ...	30/-	30/7
FOUNDATIONS OF WIRELESS. M. G. Scroggie, B.Sc., M.I.E.E. 5th Edition	12/6	13/-
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking, M.I.E.E. 3rd Edition	18/-	18/8

A complete list of books is available on application.

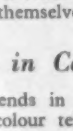
Obtainable from all leading booksellers or from

ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1.

R=1; 200÷9, R=2; 6,000÷9, R=6. Now 6,215=6,000+200+10+5; and the remainder when it is divided by 9 must be 6+2+1+5=14. But 14 divided by 9 gives the remainder 1+4=5. Hence the continuous addition. We could also work: 6+2+1=9; cast out the nine; R=5.

Multiplication

This first step shows that the continuous addition of the digits of any number gives the remainder R when it is divided by 9. Now take two numbers a and b and suppose that R_a is x and R_b is y. Then it isn't difficult to prove algebraically that for the product ab, $R_{ab}=xy$. The Proof by Nine, then, amounts to this:



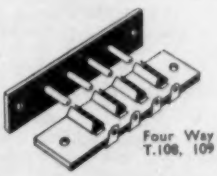
Unless the continuous addition of the product of multiplying a by b is equal to xy, the answer is wrong; if the two are equal, the answer is right—provided, as I mentioned originally, several "bloomers" are not involved. The Proof by Nine, then, is a quick and sound method of checking multiplications. Even more can be done by casting out the elevens (not the elevenses!) and I leave it to readers to chew that one over for themselves.

Television in Colour

FROM friends in the U.S.A. I gather that colour television is far from going with the expected bang. There are regular transmissions and receivers are on sale; but buyers are proving coy and their sales resistance high. I'm not surprised at that myself, for the present price of a colour receiver is three to four times that of a monochrome set. The B.B.C. is, I am sure, taking the right line by deciding not to launch colour TV in this country until it is completely satisfied that reliable systems of transmission and reception have been evolved. Nor, I imagine, would the radio industry be greatly interested in the manufacture of domestic receivers unless they could be turned out at not more than double the price of similar black-and-white models. A problem that will take a bit of solving when the time comes is that of servicing the colour sets. There are far too few first-rate servicemen as it is; and jobs such as alignment and fault finding in colour receivers are likely to call for considerably more knowledge and skill than is needed for dealing with the monochrome sets of to-day.

BLOWING OUR OWN TRUMPET

NOT that we need to blow our own trumpet; indeed, our customers do that for us. But we would like to extol the virtues of these **New Universal Multiple Strip Connectors.**...Manufactured from the finest-grade Bakelite Sheet, with rolled butt-jointed hollow pins for tip-soldering, and with fully floating self-aligning sockets with integral solder-tags. Both Pins and Sockets are Electrolytically tinned for reliable soldering. Designed for use in electronic equipment requiring multiple connections, and available in 3, 4, 5, 6, 8, 10 and 12 way models. Most competitively priced.


Four Way
T.108, 109

Five Way
T.112, 113

Six Way
T.118, 119

Also 3, 8, 10 & 12 Way Models

Another NEW BULGIN DEVELOPMENT

ELECTRICAL RATING

Insulation between adjacent poles, or to fixing screw (6.BA.), withstands **2000 v. A.C. 50 cycles test.** Maximum recommended working voltage pole to pole and poles to fixing screw is **500 v. D.C., 350 v. R.M.S. A.C.** Contact resistance measured with low-voltage D.C., at 5 Amperes, is less than **0.002 Ohm** and the maximum continuous *carrying* rating of 5 Amperes (A.C. & D.C.) per pole is conservatively fixed.

★ For full technical details send for descriptive leaflet, **Ref. WW/Multi.**

THE CHOICE OF CRITICS
BULGIN COMPONENTS

MANUFACTURERS OF RADIO AND ELECTRONIC COMPONENTS

A. F. BULGIN & CO. LTD.,
BYE-PASS ROAD, BARKING, ESSEX

Telephone: RIPpleway 3474 (5 lines)

UNBIASED

By FREE GRID

Somnidicta

IT HAS BEEN said that a specialist is one who knows more and more about less and less. This appears to apply with peculiar force to the "big shots" of the medical profession, some of whom seem quite ignorant of the ways in which other branches of science could help them. A leading psychiatrist, who has just published a weighty volume on his own particular subject, does not seem to have heard even of the existence of such very ordinary things as microphones and tape recorders, the use of which would solve at least one difficulty for which he sees no immediate solution.

It appears from his book that a lot could be learned of the causes of a patient's nervous or mental troubles if a careful record could be kept over a long period of the remarks he makes when he talks in his sleep, especially after he has been given a drug to loosen his tongue when in the arms of Morpheus. But it would be very wrong for a wife, for instance, to take a note of the morphic mutterings of her husband and attempt to base a home-made diagnosis upon them, for such "somnidicta" are symbolic rather than factual.

Thus if a man raves in his sleep of the charms of winsome Winnie or gladsome Gladys he is not talking about a contemporary blonde but of something quite different and it takes a specially trained medico to interpret his cryptic utterances. Strangely enough, I can personally confirm this, as a friend of Mrs. Free Grid once confided to her that she was much worried by her sleeping husband's references to Maggie, whom she gathered from his "somnidicta" was very reliable and amenable if you kept her well oiled.

I was fortunately able to save this marriage from disaster by pointing out that a "well-oiled Maggie" referred to the Marconi magnetic detector of which her husband would have had considerable experience as he was an ex-wireless operator of pre-1920 vintage. The excessive humidity of the tropics was apt to cause the clockwork spring of this famous old detector to rust and break unless a drop or two of the correct grade of oil was applied in due season.

In his book the good doctor bewails the fact that it is obviously impossible for him or any other expert to sit by the patient's bedside night after night to listen to his "symbolic ramblings." Has this scion of a famous medical school never heard of a tape recorder and the "Vogad" principle (used on the transatlantic telephone) whereby the patient's voice could close the switch of the recorder motor and hold it closed so long as he was speaking? Perhaps some manufacturer will market a specially designed somnigraph or somnidictaphone for the use of the medical profession.

Blind Broadcasting

MANY PEOPLE are of the opinion that ordinary sightless broadcasting will one day disappear and television will reign supreme. I don't agree with this, although I do think that eventually most of us will have TV sets, using the sound channel part of them to listen to those items which do not need a visual accompaniment. All this business of separate wavelengths for "sound-only" sets will eventually die out.

Evidently, however, the Government does not agree with me in this and is of the opinion that "sound-only" broadcasting is doomed to early extinction. If this were not so I think that the powers-that-be would have made up their minds to break the B.B.C. monopoly of sound broadcasting as well as to remove its stranglehold on TV. The fact that the panjandrums of Parliament are leaving the B.B.C. in undisputed possession of "sound-only" can only mean that they think that the days of this form of broadcasting are numbered and, therefore, it is not worth bothering about.

Such is my opinion, and if I am wrong I think that the Government ought to dispel my illusion, if illusion it be. I do know that many people share my opinion and when commercial TV gets going I do not think it will take the new Authority long to disparage the B.B.C.'s efforts by taking advantage of its initials to dub it the *Blind* Broadcasting Corporation. The younger generation will soon cotton on to this idea and will become firmly convinced that this is indeed what the initials B.B.C. really stand for.

Symbolic Somnidicta

Wireless for the Deaf

THOSE who have the misfortune to be blind are always sure of receiving the maximum of sympathy and practical help from all classes of the community, but those who are hard-of-hearing are in a far less fortunate position.

It has been my experience that this lack of sympathy with—or at any rate indifference to—the plight of the partially deaf is very real. I little thought, however, that I should read a newspaper report, as I did recently, that a responsible person like a County Court judge had said that the deaf should not be allowed to have a wireless set. His Honour was dealing with a case in which possession of some rooms was sought because the tenants, being deaf, operated their set so loudly as to cause disturbance to others in the house.

The fact that deaf people are apt to cause annoyance to others by using their sets at full blast is the fault of all of us who are radio listeners, because we do not help them with their broadcast listening as we do blind people. There are specially designed sets for the blind and an appeal is made every year on Christmas day for money to supply these sets to those who need them. Yet, so far as I am aware, there is no similar fund for supplying special sets for the deaf or to enable them to have their existing sets specially adapted.

It is not sufficient to tell deaf people to connect up a pair of headphones in place of the loudspeaker or to sit with their hearing aid near the loudspeaker. Several manufacturers do market special devices, complete with refinements like a.v.c., for installing in any sound or television set, but such things cannot be cheap while the demand for them remains so limited.

I do wonder, therefore, whether something cannot be done to help deaf listeners in the same way as the blind are assisted. There may be organizations which *are* doing something,* but they do not seem to get much publicity as is obvious from the fact that so many deaf people seem to know of no way to listen to broadcast programmes but the one which called forth the judge's irresponsible remark.

*The National Institute for the Deaf issues a leaflet giving instructions for fitting headphones to television and sound receivers.—ED.

The NEW LEAK

TL/10 AMPLIFIER & "POINT ONE" PRE-AMPLIFIER

27 GNS COMPLETE

A price made possible only by world-wide sales.

TL/10 POWER AMPLIFIER

This 10 watt amplifier maintains, in every respect, the world-renowned Leak reputation for precision engineering, fine appearance and fastidious wiring.

SPECIFICATION

Circuitry
A triple loop feedback circuit based on the famous TL/12. The output transformer is the same size as in the TL/12.

Maximum power output: 10 watts.

Frequency Response: ± 1 db 20 c/s to 20,000 c/s.

Harmonic Distortion: 0.1%, 1,000 c/s, 7.5 watts output.

Feedback Magnitude: 26 db, main loop.

Damping Factor: 25.

Hum: —80 db referred to 10 watts.

Loudspeaker Impedances: 16 ohms, 8 ohms, and 4 ohms.

"POINT ONE" PRE-AMPLIFIER

The handsome gold escutcheon plate contributes to the elegant appearance, and blends with all woods.

★ **Pickup**
The pre-amplifier will operate from any pickup generally available in the world. A continuously variable input attenuator at the rear of the pre-amplifier permits the instantaneous use of crystal, moving-iron and moving-coil pickups.

★ **Radio**
The radio input sockets at the rear permit the connection of the LEAK V.S. tuner unit. An input attenuator is fitted. H.T. and filament supplies are available from the pre-amplifier.

★ **Distortion**
Of the order of 0.1%

★ **Hum**
Negligible, due to the use of recently developed valves and special techniques.

★ **Input selector**
Radio, tape, records; any and all records can be accurately equalised.

★ **Treble**
Continuously variable, + 9 db to — 15 db at 10,000 c/s.

★ **Bass**
Continuously variable, + 12 db to —13 db at 40 c/s.

★ **Volume Control and switch**
The switch controls the power supply to the TL/10 power amplifier

★ **Tape Recording Jacks**
An exclusive feature. Readily accessible jacks are provided on the front panel for instantaneous use with Tape Recorders which have built-in (low level) amplifiers.

★ *Write for leaflet W* ★

H. J. LEAK & CO. LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3

'Phone: SHEpherds Bush 1173/4 *Telegrams: Sinusoidal, Ealux, London* *Cables: Sinusoidal, London*

9/6
Post 2/-

VIBRATOR UNIT
Complete in case—six-volt operation.

17/6
Post 2/6

Excellent resine-covered cabinet — over production by one of our very famous makers. Complete with three-colour scale and metal chassis. Suitable for battery or mains receiver. Size approx. 12in. × 9¼in. × 6in.
Limited quantity: price 17/6, postage 2/6.
Complete new working L. & M. mains superhet radio to fit this cabinet is available, price £7/10/- (limited quantity only.)

39/6
Carr. 3/6.

12" TELE-CABINET
Veneered and polished—with glass or perspex front.

1/-
Post 1/- for 5.

UNBREAKABLE GLASS PANELS
Size 10¼ × 9¼—parcel of five panels, 5/-.

12/6
Post 1/-.

CONTRACTORS PARCEL
Five-valve superhet chassis—size 15 × 5 × 2 with three-wave band glass scale, pulley, driving head, etc.

TABLE CABINET **32/6**
Veneered and polished—takes the above chassis.
Post 2/6

£9.10.0
Carr. 15/-.

CONSOLE CABINET
Walnut veneered and polished with record space and uncut motor-board.

3/6
Post 1/-.

CLOCK CASE
Veneered and polished—undrilled.

FREE THIS MONTH

Customers spending one pound or more this month will receive a free copy of our constructional booklet "The Stroller" (see last month for full details of this fine receiver). Booklet available separately price 2/6d. refunded when parts purchased.

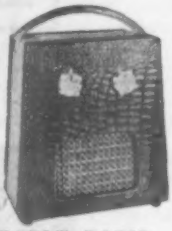
Elpeg

STROLLER

PORTABLE BATTERY RADIO

ALSO CONTAINING DATA FOR CONVERSION TO THE PICNIC PLAYER

9/6
Post 1/6



PORTABLE RADIO
With special crackle finish—with handle and back.

10/-
Carr. 3/6

BAKELITE CABINET
Two tone with built-in handle.
Note: All have slight imperfections but these are hardly noticeable and will not affect the soundness of the set.

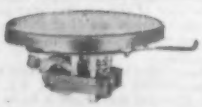
4/6
Post 1/-.

ALTIMETER
(Imperfect.) These contain aneroid barometer movement.

12/6
Post 2/6.

CONSTRUCTOR'S PARCEL
Bakelite cabinet complete with dial, pointer, metal chassis and back. Or with all the parts to make excellent T.R.F. Radio, £3/10/-.

39/6
Post 3/6.



THREE SPEED GRAM MOTOR
200-240 A.C. mains operated complete with turntable—plays 33, 45 and 78 r.p.m. records.

1/3
Post 3d.

TOGGLE SWITCH
Metal body—state dolly type required.

2/6
Post 6d.

TINSMITH'S SCRIBERS
Super quality made for the Government workshops.

2/6
100ft. post free.

CONNECTING WIRE
P.V.C. Covered in 100ft. coils — most colours—four coils different colours, 9/-.

ORDERS TO →

19/6
Post 2/-

MAINS TRANSFORMER
Fully shrouded—standard 200-250 v. primary. Sec. 300-0-300, 120 m/a., 6.3-0-6.3 at 4 amps., 2-0-2 at 2 amps.

BAKELITE CABINET 5/6 Post 1/-
Takes 3½in. speaker—ideal for desk microphone.

2/-
Post 6d.

ATTENUATOR
Inductive type for loudspeaker control.

2/6 doz.

OCTOPUS CLIP
Joins to pipes, poles, etc. Adjustable from 1¼in. to 4¼in.

4/6 doz.

COUPLING FLEXIBLE
Bellows type.

9d.
Post 6d

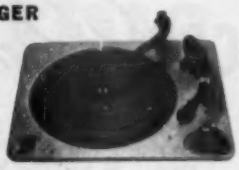
BULKHEAD INSULATOR
Pyrex glass with stud and fixing ring.

8/6
Post 9d.

MOVING COIL METERS
2½in. (3½in. across face), flush mounting, following types available: 0-30 m/a., 0-300 m/a and 0-500 m/a.

GRAMOPHONE AUTO CHANGER
COLLARO 3/521

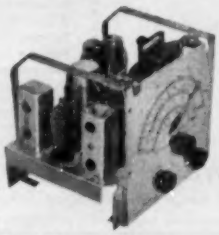
£9.19.6 carriage 7/6



The latest three-speed type with the famous "Studio" turn-over pick-up

29/6
Carriage 5/-

Our special July offer is this really beautiful walnut veneered and polished cabinet for only 29/6 if purchased at the same time as the Beethoven 5 valve superhet chassis (illustrated below). Bought separately the price of the cabinet is 49/6.



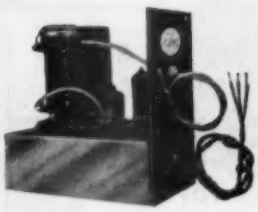
BEETHOVEN CHASSIS

£8.17.6
Carriage 5/-

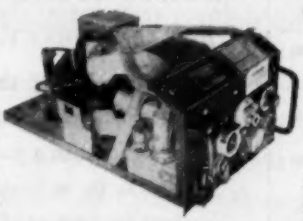
—conventional 5 valve superhet—tuning the normal long, medium and short wave-bands. An ideal general purpose receiver complete with speaker ready to operate.

T.V. E.H.T GENERATOR

69/6
Post 2/-



—gives 6 to 9 k.v. output—draws its power supplies (6.3 volt .8 amp. 250 volts 59 m/a.) from the set.



CENTIMETRE RADAR TRANSMITTER RECEIVER

79/6
Carriage 10/-

—new and complete—contains magnetron, rhumbatron, spark gaps, wave guides, pre-amp., etc. etc., costs the Government over £100 each to make.

SEND STAMP FOR SPECIAL SALES LIST—
IT IS CRAMMED FULL OF BARGAINS

1/9
Post 3d.

SAPPHIRE TIPPED GRAMOPHONE NEEDLE
Straight or trailer type.

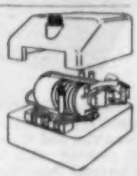
1/9
Post 6d.

THERMOSTAT
Porcelain with cover, 1 amp., 230 v. A.C.

1/9 Doz.
Post 6d.

WIRING CLEATS
Vitreous porcelain; two groove 1/9 per doz. three groove 2/9 per doz.

9/6
Post 6d.



CHARGING CUT-OUT
Bakelite case, suitable 6, 12 or 24 volts.

TRIMMER 1/3 Post 3d.
Long spindled 35 p.f.—also 2-gang 75 p.f. 2/3

59/6
Carr. 5/-

SPECIAL OUT-OF-SEASON OFFER
ELECTROS TOWEL DRIER
650 watts. Don't miss this, only a few left.

£7.10.0
Carr. 5/-

Powerful three valve mains amplifier in portable case—10in. speaker detachable, bass and treble lifts, microphone 12/6 extra.

ELECTRONIC PRECISION EQUIPMENT LTD.

152-153 FLEET STREET, E.C.4.
Phone: CENTRAL 2833
Half-day Saturday

42-46 WINDMILL HILL, RUISLIP, MIDDX.
Phone: RUISLIP 5780
Half-day Wednesday

29 STROUD GREEN ROAD, FINSBURY PARK, N.4.
Phone: ARCHWAY 1049
Half-day Thursday

Personal shoppers to any address. Post orders to Ruislip (Dept. 2).

HEAR THE DECCA *Panatrope* AT *Holley's*

● Garrard 3-speed automatic record changer, type RC111. Capacity 8 records of any one size and speed ● Decca ffrr magnetic pick-up with interchangeable heads and internal bass compensation for microgroove and 78 r.p.m. records. Sapphire styli.

● Amplifier, output 2.5 watts. ● 8in. dynamic speaker. ● Provision for external speaker. ● Controls: Volume/On-off; Tone with treble emphasis and bass lift. ● Handsome hand-polished cabinet finished in walnut, 24½in. x 22½in. x 15½in. ● Record storage space. ● 200-250 v. A.C.

45 GNS. (INCL. P.T.) **H.P. TERMS AVAILABLE**

Also In Stock

PICK-UPS AND AUTOCHANGERS

New Leak moving coil pick-up with detachable heads. With one diamond stylus (78 or L.P.)	£11	9	6
Transformer, extra	£1	15	0
Decca XMS with new type H Hi-Fi Head	£6	9	3
Connoisseur P/U with head	£5	19	3
Extra heads	£3	6	3
Connoisseur 3-speed Motor	£21	17	3
Garrard 75a less head	£13	10	0
Garrard 80 less head	£15	3	3
Garrard T. 3-speed	£10	0	2
Collaro, Studio type O or P	£4	0	8

TAPE RECORDERS AND TELEVISION

Grundig	£78	15	0
Grundig Console	£99	15	0
Wearite Tape Deck	£35	0	0
Truvox Tape Desk	£23	2	0
Television by leading manufacturers.			

AMPLIFIERS

Leak TL/10 and TC	£28	7	0
Sound Sales and TC	£20	0	0
Sound Sales Senior	£32	0	0
G.U.A.D. and TC	£42	0	0
RD Baby de Luxe with RD Senior Control Unit	£29	0	0
RD Senior	£28	0	0

RADIO TUNERS

Sound Sales A-Z	£17	4	0
Chapman S4	£16	0	0
Rogers	£25	16	1
Leak V/S	£36	1	3
Armstrong 8 Receiver	£23	13	0
Lowther A.M.-F.M. Tuner	£22	0	0
Chapman F.M. Tuner.			

LOUDSPEAKERS

Goodmans Axiom 150 Mk. II	£10	5	6
Wharfedale Super 5 and 8	£6	13	3
Wharfedale W 12 C/S	£9	15	0
Wharfedale 3 Unit Corner	£72	0	0
Tannoy 15in. Dual Concentric	£33	10	0
Tannoy 12in. Dual Concentric	£27	10	0
Stentorian H.F. Unit from	£2	10	6
Barker Duode	£12	12	0
Rogers Corner Cabinet	£19	19	0
Wharfedale W.15 C/S	£17	10	0
Wharfedale Golden 10	£7	13	3
Goodmans 101 and 102 from	£6	12	1

HOLLEY'S RADIO, 285, CAMBERWELL ROAD, LONDON, S.E.5

Telephone: RODney 4988 Hours: 9.30-6.0 p.m. Including Saturdays

Hire Purchase Terms Arranged, Export Orders Accepted, Technicians who will Install our Equipment in your Home to the best Acoustical Advantage

WE SHALL BE AT THE **RADIO SHOW** EARLS COURT AUG 25 - SEPT 4

SEE THE NEW RANGE OF PRODUCTS BY

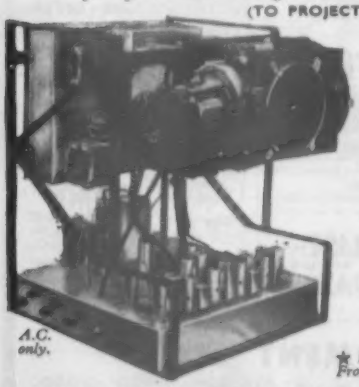
'TELEMAX'

AND THE EVER-POPULAR

PROJECTION TELEVISION

for your Own-Styled Cabinet

(TO PROJECT 4' x 3' PICTURE)



A.C. only.

★ 23-valve Superhet circuit.

★ Sensitivity better than 50 microvolts.

★ Full bandwidth. 5-channel facility

★ Complete with valves, c.r.t. and optical unit.

★ Chassis size approx. 19" x 17" x 15".

★ *Detailed Specification From the Manufacturers.*

TELEMECHANICS LTD.

3, NEWMAN YARD, NEWMAN ST., LONDON W.1

LANgham 7965

A valuable new book for electrical and electronics engineers

LAPLACE TRANSFORMS FOR ELECTRICAL ENGINEERS

By B. J. STARKEY, DIPL. ING., A.M.I.E.E.

A presentation of the theory of Laplace transformation in which a physical vocabulary rather than a purely mathematical one is used as far as possible. This method of analysis has become of increasing importance to electrical engineers in many fields, and the work is designed to provide a thorough treatment of the subject in a language with which they will be familiar.

Ready this month **30s. net.** *By Post* 30s. 8d.

From booksellers or direct from :—

Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1

from all this

to just this

The EVER READY development that revolutionised the DRY BATTERY

The "Batrymax" dry battery is an Ever Ready development that made possible the miniature self-contained hearing aid and the smaller, lighter electronic equipment of today. In addition, Ever Ready "Batrymax" layer-cell construction gives you more efficient, more economical radio batteries. For example, the latest B136 "Batrymax" battery, used with new Ever Ready low consumption valves, has a balanced service life of over 400 hours. At the present time, you cannot better a "Batrymax"; but Ever Ready research goes on, seeking new developments to increase, still further, the efficiency of the dry battery.

EVER READY REGD. TRADE MARK MADE IN BRITAIN

Batrymax

"Batrymax" is a Trade Mark of The Ever Ready Co. (Gt. Britain) Ltd.

we manufacture AND STOCK many unusual transformers as regular catalogue lines.

TYPE AV 479
Primary
10-0-200-220-240v. 50~
Secondary
4v. 2 amps 10kV RMS Wkg.
One of 370 standard types in stock for "off-the-shelf" delivery

write for illustrated and fully descriptive catalogue.

GARDNERS RADIO Ltd

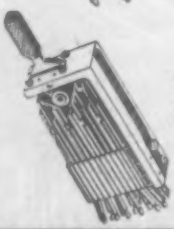
CHRISTCHURCH, HAMPSHIRE

Tel. Christchurch 1024

MANUFACTURERS of

MAGNETIC RELAYS

POST OFFICE TYPE



3,000 and 600

Contractors to:

H.M. GOVERNMENT AND LEADING MANUFACTURERS

COILS up to 80,000Ω.

CONTACTS up to 8 amps.

INSULATION up to 5 kV.

Specialists in Tropicalisation and Inter Services Jungle Finish.

Conforming to A.I.D. and C.I.E.M.E. standards.

PROTOTYPE Relays made to specification.

POST OFFICE TYPE KEYS supplied to specification.

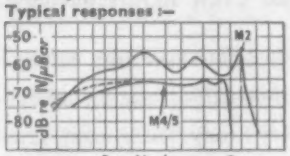
Speedy deliveries
Enquiries invited

A.D.S. RELAYS LTD. Dept W.W.
12, STORE STREET, LONDON, W.C.1.
Tel. MUSeum 2433

...but not for small talk!

Designed originally for use in Hearing Aids, Amplivox miniature c.m. microphones are now doing a full size job in industry and commerce. Possessing a frequency characteristic virtually level from 0.4 to above 4.5 Kc/s, speech quality is excellent. These robust and inexpensive microphone inserts have found wide acceptance for speech recording, mobile VHF, and aircraft communication systems.

Typical responses :—



SPECIFICATIONS

MODEL M.2: 0.4 to 6.5 Kc/s : dia. 0.84" x 0.520" deep. Weight ½-oz. Sensitivity -55 dB re : 1V dyne/cm². (Std. Z = 5,000 ohms)

MODEL M.4/5: Illustrated: 0.4 to 5 Kc/s: weight ⅝-oz. M5 similar to M4 with polythene membrane for close-speaking applications. (Std. Z = 600 ohms)

Enquiries invited. *Prices on application*

AMPLIVOX LTD

2, Bentinck Street, London, W.1. WELbeck 2591

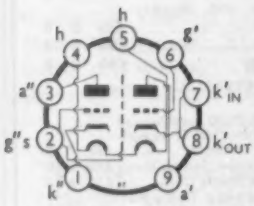
Osram

VALVES for BAND III TELEVISION

B319 **Cascode R.F. amplifier**

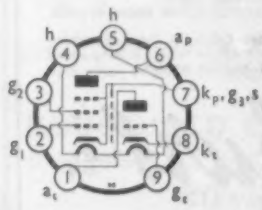
LZ319 **Triode pentode frequency changer**

Introduced to meet the special 'front end' requirements of V.H.F. television receivers, these new OSRAM valves enable a high performance to be obtained at these frequencies with simple and inexpensive circuitry.



B319 Double triode designed for use as a series cascode R.F. amplifier with the accompanying advantages of high gain and good signal to noise ratio. The high slope at low anode voltage ensures efficient operation at H.T. supplies of 180V. The maximum heater-cathode has been increased to 250V to meet the special requirements of this application.

Heater
I_h 0.3A
V_h 7.0V
Characteristics (per system)
V_a 90V
V_g −1.5V
I_a 12 mA
μ 24
r_a 4 kΩ
g_m 6 mA/V
Base B9A



LZ319 Triode pentode designed for use as a frequency changer following the B319 cascode amplifier. The LZ319 operates efficiently at H.T. voltage of 170-180, and gives a high conversion gain with standard circuitry.

Heater
I_h 0.3A
V_h 9.0V

Characteristics	pentode system	triode system	
V_a	170	100	V
V_{g2}	170		V
V_{g1}	−2	−2	V
I_a	10	14	mA
μ_{g1-g2}	50		
μ		20	
r_a	400	4	kΩ
g_m	6	5	mA/V

Base B9A

Write to the Osram Valve & Electronics Dept. for further information

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

ERICSSON TELEPHONES LTD.

HAVE VACANCIES FOR

SENIOR AND JUNIOR RESEARCH AND DEVELOPMENT ENGINEERS AND DRAUGHTSMEN

to work in their Research Laboratories at Beeston, Nottingham. Posts are available in rapidly expanding departments engaged in work on nucleonic equipment, valve developments, electronic switching and computing, and mechanical design and engineering of prototypes of apparatus, including preparation of drawings to IDP13.

Posts offer excellent prospects of promotion; applicants for research posts should have an honours degree or equivalent, and for senior posts must have several years' experience in appropriate work.

Applications, giving details of age, qualifications, experience and desired starting salary, to PERSONNEL OFFICER, ERICSSON TELEPHONES LTD., BEESTON, NOTTINGHAM.

SCALAMP ELECTROSTATIC VOLTMETER

Cat. No. W.W. 11310

DIRECT READING.
ZERO CURRENT DRAIN.
THREE SECONDS PERIOD.
LAMP OPERATES FROM MAINS OR 4 VOLT BATTERY.
BRIGHT SPOT-AND-HAIRLINE INDICATOR.

This instrument introduces a completely new conception of electrostatic voltmeter. It is compact, portable and robust, and does not require critical levelling or special mounting. The movement has a taut suspension, is critically damped, and readings can be taken with rapidity and ease. Three models are available:

Cat. No. W.W. 11308 1-5 kV A.C. D.C.
Cat. No. W.W. 11309 3-10 kV A.C. D.C.
Cat. No. W.W. 11310 5-18 kV D.C. and 5-12 kV A.C. R.M.S.

Please write for illustrated leaflet.

SCIENTIFIC PYE INSTRUMENTS

W. G. PYE & CO. LTD., GRANTA WORKS, CAMBRIDGE

ASK ARTHURS FIRST

★ **NEW VALVES** Send your enquiries for all Radio and Electrical goods, especially those in short supply.

We have probably the largest variety of valves in the country. Let us know your requirements.

AVO METERS IN STOCK

Avo Model 7	£19 10 0
Avo Model 8	£23 10 0
Signal Generator, Mains and Battery Models	£30 0 0
Electronic Test Meter	£40 0 0
Valve Characteristics Meter	£60 0 0

Also full range **TAYLOR METERS**. List on request.

VALVE MANUALS

Mullard	5 0
Osram	5 0
Brimar No. 5	5 0
Mazda, Part 2	2 0
Mullard Valve Replacement Guide	2 6
Art and Science in Sound Reproduction by F. H. Brittain, D.F.H.	2 6

Postage 6d. each extra.

Leak TL/10 Amplifier and "Point One" Preamplifier complete	£28 7 0
Chapman Tuning Units	£17 6 8
Leak Tuning Unit	£35 6 3
Grundig Tape Recorder	£60 5 0
Grundig Microphone	£6 6 0

Recording Tapes: All makes in stock.

Terms C.O.D. or Cash with order. Goods offered subject to being unsold and to price alteration.

Arthurs EST. 1919

PROPS: ARTHUR GRAY, LTD.

GRAY HOUSE, 150-152 CHARING CROSS ROAD, LONDON, W.C.2
TEMple Bar 5833/4 and 4765. Cables: TELEGRAY, LONDON

for

SELENIUM RECTIFIERS

consult

ELECTRIX

WHETHER the need is for a single unit or a supply running into thousands . . . if it's a Selenium Rectifier that must fulfil critical requirements and maintain its characteristics over long periods . . . the answer is to be found with Electrix.

- **Electrix Rectifiers are characterised by their cool running and consistent long-life conformity to stated specification.**
- **Manufacturers, Traders and Electronic Engineers, send us your specific requirements.**
- **Your needs may possibly be met from "standard" types, or**
- **"To specification" models can be quickly prepared.**
- **Quotations by return . . . and deliveries a matter of days only.**
- **We welcome export enquiries.**

Here are some typical "standard" full-wave types

		each
Output 12/15 Volts D.C. 1 Ampere.	List Price	9/-
Output 12/15 Volts D.C. 2.5 Ampere.	„	13/6
Output 12/15 Volts D.C. 4 Ampere.	„	22/6
Output 12/15 Volts D.C. 6 Ampere.	„	35/-

Trade Supplied

- **Heavy duty rectifiers with say 230/250 volts A.C. input and 220 volts D.C. output a speciality.**
- **We use only freshly manufactured selenium plates and components, no ex-W.D. materials whatsoever.**

HOUSEHOLD ELECTRIX LTD
47-49 HIGH ST., KINGSTON-ON-THAMES
Telephone: KINgston 4585

L·R·S
Estd. 1925
EASY TERMS

LEAK QUALITY EQUIPMENT
for the Connoisseur

The completely New
"TL/10" AMPLIFIER and
"POINT ONE" PRE-AMPLIFIER

This 10-watt amplifier maintains, in every respect, the world-renowned LEAK reputation for precision engineering, fine appearance, and fastidious wiring. The Pre-amplifier will operate from any well known pick-up, whether crystal, moving iron or moving coil. Provision is made for Tape Recorder and Playback and as an exclusive feature, readily accessible jacks are provided on the front panel for instantaneous use.
See maker's advertisement—Page 87 for full technical specification.

The total Cash Price for these Two Units is £28.7.0 and our EASY TERMS are £3 Deposit with order and 8 monthly instalments of 70/- carriage paid (crate returnable).

HIRE PURCHASE TERMS also available OVER 15 MONTHS

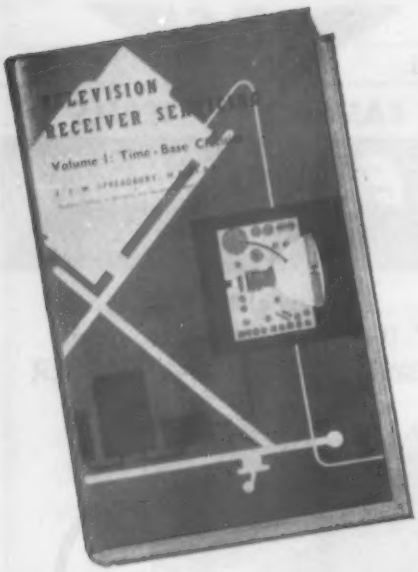
If you require FINEST QUALITY REPRODUCTION together with WORKMANSHIP of the HIGHEST ORDER your choice must be

★ LEAK ★

The very latest LEAK DYNAMIC PICK-UP with detachable heads is now available.

Suitable Wharfedale, Tannoy & Goodmans Loudspeakers and the latest Connoisseur 3-Speed Motors & Pick-ups are also available on EASY TERMS.

The L.R. SUPPLY COMPANY LTD.
BALCOMBE Telephone: Balcombe 254 **SUSSEX**



Filling a long-felt need

A valuable, practical book for television service engineers

Although written specially for the radio servicing engineer who wishes to embark on TV servicing, this book will be invaluable to everyone interested in TV receiver fault-finding. It is written for the practical man in terms he understands, and is fully illustrated by many clear diagrams. It is strongly recommended to prospective candidates for the R.T.E.B.—City & Guilds TV Servicing Certificate Examinations and will be of particular help in the Practical Test.

TELEVISION RECEIVER SERVICING 21s. net. *By Post 21s. 8d.*

Published for "Wireless & Electrical Trader"

obtainable from booksellers or direct from Iliffe & Sons Limited, Dorset House, Stamford Street, London, S.E.1

HIGH FIDELITY REPRODUCTION

WITH A MINIMUM OF WEAR

Calls for the use of

S. G. BROWN *PRECISION* **SAPPHIRE NEEDLES**

No. 1 "Miniature" Jewel-tipped needle for *Lightweight* pick-ups.
No. 2 "Straight" Jewel-tipped needle for *Crystal* pick-ups.
No. 3 "Trailer" Jewel-tipped needle for *Medium* weight pick-ups.
No. 4 "Knee Bend Trailer" Jewel-tipped needle for older type *Heavy* weight pick-ups.
No. 5 "Miniature Solid Sapphire" needle for *Lightweight* pick-ups.

PRICES (Subject to full Trade Discount)
Nos. 1-4, 7/-, plus 2/4 P.T. Post 6d.

No. 5, 9/3, plus 3/1 P.T. Post 6d.

Nos. 1 and 5 now available with .001" radius tips, for long playing records. Prices as above.

There's an S. G. BROWN *PRECISION* **SAPPHIRE NEEDLE for every type of PICK-UP**

An instructive and interesting Brochure gladly sent on request. Write to Dept. W.

S G Brown Ltd. SHAKESPEARE ST. WATFORD, HERTS.

---

direct TV

REPLACEMENTS

134-136 LEWISHAM WAY, NEW CROSS, S.E.14.

Tel : TIDeway 3696-2330.

OFFERS DEALERS AND SERVICE ENGINEERS

ANTI-STATIC 0136. 4/6 + 6d. pkg. & post tube. Applied to the potential points of E.H.T. transformers and cathode ray tubes, it provides a remedy for corona discharge.

CORE-LOCKING COMPOUND 86. Lock iron dust core screws of I.F. transformers with this compound. It does not perish or harden. Cores may be adjusted at any time without any danger of cores splintering or formers breaking. 4/6 + 6d. packing & post per tube.

WE HAVE THE LARGEST STOCK OF EXACT TELEVISION REPLACEMENTS IN ENGLAND —TRANSFORMERS FOR OVER 700 MODELS SUPPLIED BY RETURN POST.

If we cannot replace, we rewind in our own factory. Normal rewind time 48 hrs. for line outputs and other time-base windings. Mains types 7-10 days.

Send 9d. stamps for replacement and rewind manual. This is not just a price list, but a valuable reference for service engineers. Various modifications are given, also a guide to sliders and controls.

Rola Celestion

The Final Word

In all radio reproduction it is the LOUDSPEAKER which has the Final Word. It is the LOUDSPEAKER which finally determines the quality of reproduction.

The finest radio receiver in the world can only give indifferent results if fitted with an indifferent LOUDSPEAKER.

It is the LOUDSPEAKER which re-creates the sound and it is the LOUDSPEAKER above all which must be BEYOND REPROACH.

Model P44
Lightweight 12" Loudspeaker

We have loudspeakers for every purpose and set manufacturers are invited to collaborate with us on all problems relating to sound reproduction.

Rola Celestion Ltd. FERRY WORKS, THAMES DITTON, SURREY
Telephone: Emberbrook 3402-6

MODERN ELECTRICS LTD.,

164, Charing Cross Road, London, W.C.2.

Tel.: TEMple Bar 7587.
Cables: Modcharex, London.

Export enquiries welcomed. *Immediate delivery from stock.* *Prompt attention to post orders.*

TAPE RECORDERS

GRUNDIG TK9	£68 5 0
BAIRD Soundmaster	£68 5 0
BAIRD Mk. II	£61 19 0
FERROGRAPH 2A	£79 16 0
VORTEXION 2A	£84 0 0
EDITOR	£47 5 0
WEARITE TAPE DECK	£35 0 0
TRUVOX TAPE DECK	£23 2 0

RECORDING TAPES

GRUNDIG	
L.G.S. 1,200ft.	£2 0 0
850ft.	£1 14 0
FERROVOICE	
1,200ft.	£1 2 6
Spare Spools	4 6
E.M.I. 1,200ft.	£1 15 0
E.M.I. 600ft.	£1 1 0
GEVAERT	
1,200ft.	£1 15 0
SCOTCH BOY	
1,200ft.	£1 15 0
600ft.	£1 1 0
Spare Spools, 1,200ft.	4 3
Spare Spools, 600ft.	3 3
FERROGRAPH	
1,200ft.	£2 5 0
1,750ft.	£3 3 0
8½in. Spools	9 6
AGFA	
1,200ft.	£1 17 6
600ft.	£1 2 6
Lead on tape 150ft.	8 0

RECORD REPRODUCING EQUIPMENT

COLLARO TRANSCRIPTION	
Model 2000	£13 9 6
Model 2010	£18 6 6
GARRARD UNITS	
RC75A, RC75 a.c./d.c., RC80A, TA/AC, TA/B for Decca heads.	
CONNOISSEUR	
3-spd.	£23 8 11

SPEAKERS

TRUVOX	
12in. 3Ω	£2 5 0
W.B. STENTORIAN	
HF. 610	£2 10 6
HF. 810	£3 0 6
HF. 912	£3 7 0
HF. 1012	£3 13 6
GOODMANS	
Axiom 150 Mk. II	£10 5 6
Axiom 102	£9 18 2
Axiom 101	£6 12 1
WHARFEDALE	
W1S CS	£17 10 0
Super 12 CS/AL	£17 10 0
W12 CS	£9 15 0
Golden 10 CSB	£8 6 7
Super 5 and 8 CS/AL	£6 13 3
Bronze 10in.	£4 12 9
Bronze 8in.	£3 4 8
W.B. Crossover Unit	£1 6 6
W.B. Tweeter Unit	£3 15 6

TEST EQUIPMENT

AVO	
Model 8	£23 10 0
Model 7 (latest)	£19 10 0
Uniminor Mk. II	£10 10 0
Electronic Meter	£40 0 0
Wide Band Sig/Gen.	£30 0 0
Valve Characteristic Meter	£60 0 0
D.C. Minor	£5 5 0
10kV Multiplier for Model 8	£3 5 0
Carrying Cases for Models 7, 8 and 40	£3 0 0
ADVANCE	
H.1 (Sig/Gen)	£25 0 0
E.2 (Sig/Gen)	£28 0 0
J.1 New Model	£35 12 0
P.1	£19 19 0
COSSOR	
Oscilloscope 1035	£120 0 0
Oscilloscope 1052	£104 0 0
Volt: Calibrator 1433	£18 5 0
TAYLOR	
All new Taylor Test Gear in stock.	

PICK-UPS

ACOS	
Hi G 20	£3 6 1
DECCA	
X.M.S. Magnetic	£6 9 5
CONNOISSEUR	
Super L/weight	£9 5 6
Spare Heads	£3 6 3
COLLARO STUDIO	
Type O or P	£3 14 4

MICROPHONES

ACOS	
Mic 22 (Crystal)	£4 4 0
Mic inserts for above	£1 0 0
Mic 16 (Crystal)	£12 12 0
Mic 35-1 (Crystal)	£1 5 0
LUSTRAPHONE	
M/C with T/F C51	£5 15 6
Table base for above	£1 1 0
RESLO M/C (Low Imp.)	£6 0 0
URA Ribbon	£7 5 0
RVA Ribbon	£9 0 0
Mumetal Transformer	£1 15 0
MICROPHONE STANDS	
Floor, 3 extensions	£3 12 6
Table Stand	£1 1 0
LEAK AMPLIFIERS	
TL.10	£28 7 0
Point 1, TL.12	£28 7 0
Point 2, TL.25	£34 7 0
Vari-slope pre-amp.	£12 12 0
Type VS RF Tuner Unit	£35 1 3
SOLON. New Instrument Iron 200-250 v. 25 w.	19 8

ALL GARRARD, CONNOISSEUR, DECCA and COLLARO HEADS. SAPPHIRE and DIAMOND STYLI for the above HEADS NOW AVAILABLE.

H.P. Terms available on all items over £10. 0. 0.

GARLAND BROS, Ltd.

"UNITELEX PRIMA" PORTABLE TAPE RECORDER. Incorporating the latest Truvox Tape Deck. Features include ultra modern cabinet design, giving exceptional lightness and portability without sacrifice of quality. Push-button control on mechanical side, twin-track heads, dual-speed (7½in. and 3¾in. per sec.), giving up to two hours playing on one reel of tape; latest type miniature valves used; genuine 10 kcs. response; separate bass and treble controls; magic eye recording level indicator; provision for use as straight playback amplifier from record players or changers; 4-watts output to internal 10in. elliptical high-flux speaker, with provision for feeding two external speakers or amplifiers. Price, complete with filter cell microphone housed in recorder, and with 1,200ft. reel of high coercivity tape, 57 guineas. H.P. terms 19 gns. deposit, 12 monthly payments of £3/13/2. Send 2½d. stamp for illustrated brochure.

GARLAND AMPLIFIER AC11. Self-contained general-purpose amplifier, providing 3.5-watts output. All power supplies derived from mains transformer, ensuring isolated chassis. Standard valves throughout. Volume and Tone Controls incorporated. Negative feedback loop. Price £6/12/6 plus 5/- carriage, etc. Weight 10lb.

TRUVOX TAPE DECK MARK III. Incorporating high impedance mu-metal twin-track heads. Two-speed capstan, for tape speeds of 7½ and 3¾ inches per second. Three heavy-duty motors allowing for fast forward and rewind facilities without tape handling. All controls operated by electrically and mechanically interlocked push buttons. Price £23/2/-. Send S.A.E. for full particulars. Plus 10/- carriage, etc. Delivery from stock. Send 2½d. stamp for details of this and of suitable amplifier.

THE FINEST H.P. TERMS IN THE BUSINESS	Cash Price	Deposit	6 monthly payments	12 monthly payments
Goodmans Axiom 101. 8in. L/Spkr.	£6 12 1	£2 4 1	15 9	8 1
Garland Amplifier AC11A	£6 12 6	£2 4 2	15 9	8 1
Wharfedale Golden CBS. 10in. speaker	£8 6 7	£2 15 7	19 11	10 2
Goodmans Audiom 60 Speaker	£8 12 6	£2 17 6	£1 0 8	10 7
B.S.R. 3-speed single player. GU4	£9 5 0	£3 1 8	£1 2 2	11 4
Connoisseur Pick Up, 2 heads	£9 5 6	£3 1 10	£1 2 2	11 4
Leak Pre-Amplifier	£9 9 0	£3 3 0	£1 2 7	11 7
Wharfedale W12/cs. 12in.	£9 15 0	£3 5 0	£1 3 4	11 11
Goodmans Axiom 150, Mk. II	£10 5 6	£3 8 6	£1 4 7	12 7
Stella 3-speed Single Player	£10 10 0	£3 10 0	—	12 10
Leak "Varislope" Pre-Amplifier	£12 12 0	£4 4 0	£1 10 2	15 6
Collaro Auto-changer. 3RC/531	£15 3 10	£5 1 4	—	18 8
B.S.R. "Monarch" 3-speed Auto-change	£16 10 3	£5 10 1	£1 19 6	£1 0 3
Lane Tape Desk, Mk. IV	£17 10 0	£5 16 8	£2 1 10	£1 1 5
Collaro auto-changer. 3RC/532	£17 10 0	£5 16 8	—	£1 1 4
Connoisseur 3-speed unit	£23 8 11	£7 16 4	—	£1 8 8
Truvox Tape Deck, Mk. III	£23 2 0	£7 14 0	£2 15 3	£1 8 3
Leak "Point One" Amplifier	£28 7 0	£9 9 0	£3 7 9	£1 14 8
Q.U.A.D. Amplifier with pre-amplifier	£35 0 0	£11 13 4	£4 3 8	£2 2 9
Unitelex "Prima" Tape Recorder. (Described above).	£59 17 0	£19 19 0	£7 3 0	£3 13 3

ALL GOODS NEW AND UNUSED (except where otherwise stated).
PLEASE ADD POST OR CARRIAGE ON ALL ITEMS. KINDLY PRINT NAME AND ADDRESS. POST ORDERS TO OUR DEPTFORD ADDRESS. EARLY CLOSING THURSDAY, OPEN ALL DAY SATURDAY.
SHOP HOURS: *Mon: Tues: Wed: and Sat: 9 a.m.—6 p.m. Thurs: 9 a.m.—1 p.m. Fri. 9a.m.—7 p.m.*

GARLAND BROS. LTD.
CHESHAM HOUSE, DEPTFORD BROADWAY, S.E.8.

5 OBELISK PARADE, LEWISHAM, S.E.13.
TEL.: LEE GREEN 4038
TEL.: TIDEWAY 4412/3

WHY NOT BUILD YOUR OWN?

Not only are the RECEIVERS, AMPLIFIERS AND TEST EQUIPMENT in our Handbook second to none in performance and looks, but the knowledge that you have BUILT IT YOURSELF will make you EXTRA PROUD! The secret of *first-time success* lies in using our **ALIGNED COMPONENTS**, including ready-punched chassis, and fully identified parts. REMEMBER, NO ALIGNING OR TEST GEAR REQUIRED! and with our "EASY AS A.B.C." CONSTRUCTION SHEETS it's like "falling off a log"! SEND 2/6 NOW for our famous "HOME CONSTRUCTOR'S HANDBOOK" containing on 50 glossy art pages full information enabling you to build ALL of the following high-class equipment:—

★ 3-VALVE 3-BAND SUPERHET. FEEDER UNIT.
★ 4-VALVE 3-BAND SUPERHET. "NORM./HI-FI/GRAM." FEEDER UNIT.
★ 4-VALVE 3-BAND A.C. SUPERHET. (P.W. "CORONET.")
★ 5-VALVE 3-BAND A.C. SUPER. (with Gram.)
★ 5-VALVE 3-BAND A.C./D.C. SUPERHET.
★ 6-VALVE 3-BAND A.C. SUPER. (with Gram.)
★ 6-VALVE 3-BAND A.C./D.C. SUPER. (with Gram.)
★ 3-VALVE 2-BAND "LOCAL STATION" SUPER QUALITY FEEDER W/BASS-TREBLE CONTROL.
★ FEEDER AMPLIFIER AND POWER PACK.
★ MAGIC EYE TUNING INDICATOR UNIT.
★ SIGNAL TRACER A.C.
★ 5-WATT QUALITY AMPLIFIER A.C. with NFB.
★ 10-WATT P-P QUALITY AMP., A.C. with NFB.
★ SIGNAL GENERATOR, A.C., etc., etc.

REMEMBER NO TEST GEAR REQUIRED!

Apart from construction details and large *blueprint* circuits, it contains complete parts lists and technical descriptions of these outfits, set building hints, servicing hints and tips, facts and formulae, resistance colour Code, symbols, data, etc. AND our current catalogue. This publication is now acknowledged to be at the top of its class! Over 70,000 copies sold! All parts always in stock.

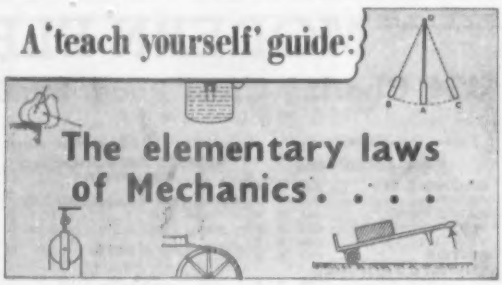
Be wise and

DON'T DELAY—SEND FOR YOUR COPY TO-DAY!

Also obtainable from W. H. Smith & Son, and leading booksellers

RODING LABORATORIES
(Dept. WW8) BOURNEMOUTH AIRPORT, CHRISTCHURCH

A 'teach yourself' guide:



Mechanics for the Home Student

by Eric N. Simons

In association with W. D. Burnett, B. Eng.

A valuable book providing a plain explanation of the elementary laws of mechanics that will be comprehensible to anyone.
It is especially useful to those unable to attend organised classes, being a comprehensive "teach yourself" volume that can readily be followed with no previous knowledge of the subject and without the aid of a teacher.
Published for "Mechanical Handling."

8¾" × 5¼" 152 pp. 132 diagrams **7s. 6d. net.** *By post 7s. 10d.*

From booksellers or direct from:—
Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1

WE PAY TOP PRICES

FOR

AMERICAN SURPLUS ELECTRONIC EQUIPMENT

LOOK AT THESE EXAMPLES

for equipment in good condition

Receiver, R54/APR4, complete	**£200**
Transmitter, ET4336	**£110**
Scanner, RC94	**£100**
Test Set, TS13	**£100**
Frequency Meter, TS175/U	**£80**
Frequency Meter, BC221	**£26**
Receiver, BC348R	**£25**
Receiver, R89/ARN5	**£25**
Control Box, 23270	**£5**
Klystron, 723A/B	**£3**

We pay similar remarkable prices for:—

RECEIVERS. R111/APR5, R5/ARN7, AR88D, R65/APN9, BC1033, BC348.

TRANSCEIVERS. ARC1, ARC3, TCS, BC800, RT1/APN2.

TRANSMITTERS. T11/APN3, ART13.

INDICATORS. ID17/APN3, BC1151, BC1152, I-81A.

TEST SETS. Any unit with prefix "TS" and IE19, I-208, I-100.

MODULATORS. BC1091, BC1142.

SYNCHRONISER. BC1148.

POWER UNITS. RA34, RA42, RA62, RA88, RA90, MG149, PE98, PE158, DM28, PU16.

TUNING UNITS. TN17, TN18, TN19, TN54, TU57, TU58, TU59.

CONTROL GEAR. BC1150, BC1145, JB91, JB95, JB98, JB102, C45-ARC1.

And almost every American made unit even if not mentioned above.

Phone us immediately, transfer charge.

TO OVERSEAS BUYERS

We have the largest stock in Europe of American Government surplus electronic equipment and we would be pleased to quote by return of post against your enquiries. The following are a few examples only of the equipment which we can supply from stock.

ET4336 Transmitter.
SCR720C Search Radar, complete
BC348 Receiver.
ART13 Transmitter.

Deal with the firm that has been established for twenty-five years.

ALTHAM RADIO CO.

JERSEY HOUSE, JERSEY ST.

MANCHESTER 4

Telephone: Central 7834/5/6

IF NOT ORDERING TODAY MAY WE SUGGEST YOU PLACE A "BOOK-MARK" HERE FOR FUTURE REFERENCE

WOULD YOU DO THIS...

to the soldering instrument you are at present using?

On March 6th *three* "LITESOLD" eighth in. bit models were connected to a 240V Mains and have been left connected day and night ever since. Tested daily, they were still functioning satisfactorily when this advertisement went to press.

What a robust mains element—over 2,000 hours saturation test and still doing the job!

Remember, this "LITESOLD" model is the smallest in the world with a fully insulated mains element—see its specification below.

SPECIFICATION

Size of Bit diameter	Weight (Less Flex)	Length	Loading
Fixed or replaceable	oz.	inch	watts
1/8"	¼	6	12
5/32"	1¼	8¼	23
3/16"	2	9¼	27
¼"	3½	10¼	40

PRICES

⅛" Fixed Bit, 19/6. 5/32" Fixed Bit, £1/1/-.
3/16" Fixed Bit, £1/2/6. ¼" Fixed Bit, £1/5/6.
⅛" Replaceable Bit, £1/1/6. 5/32" Repl. Bit, £1/4/-.
3/16" Replaceable Bit, £1/5/6. ¼" Repl. Bit, £1/8/6.

LITESOLD ACCESSORIES

SAFETY SHIELD

(Regd. design No. 871109)

These shields have been designed to suit the range of "LITESOLD" instruments and meet requests for safety shields which can be used at the work-bench. By using a Safety Shield between soldering operations, not only will the risk of accidental burns be eliminated, but restoration of heat to the bit tip is facilitated in the vertical position, and the handle is readily accessible when again required for use. It may be mounted near the front of the bench, or alternatively may be fixed to a wall or partition. The shields are made in Duralumin and normally have a red anodised finish, but other colours are available to special order.

Prices

⅛" Bit Model	5/-
5/32" Bit Model	5/6
3/16" Bit Model	5/6
¼" Bit Model	6/6

HEAT GUARD

(Pat. Pending and Regd Des. Applied For)

The increasing use of Polythene and P.V.C. insulation and the miniaturization of modern electronic equipment has now made some form of protection against burns to insulation during soldering operations desirable if not essential. The unique "LITESOLD" Heat Guard attachment eliminates the risk of damage to wiring and heat sensitive components when working under normally inaccessible or congested conditions.

The Heat Guard is made from spring steel wire and is Chromium Plated. It is exceptionally strong yet so light that it does not affect the balance of the Instrument. Fitted in an instant by merely pushing into the handle tube. Its unique design avoids any obstruction to the operator's field of vision.

Prices

⅛" Bit Model	4/6
5/32" and 3/16" Bit Models	4/9
¼" Bit Model	5/-

Like some more 'Gen'—then write to the Sole Manufacturers.

LIGHT SOLDERING DEVELOPMENTS LTD

106, GEORGE ST., CROYDON, SURREY

Telephone: CROYDON 8589

CITY SALE & EXCHANGE LIMITED

THE HI-FI SPECIALISTS

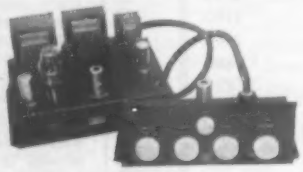
90-94 Fleet Street, London, E.C.4 **Phone: Central 9391/2**

All the following are available from stock :

Special Offers :

Lino-a-Tone Tape Deck, as new... £10 10 0
Truvox Tape Deck, shopsoiled only ... £18 18 0
Lane Tape Deck, shopsoiled only £15 15 0
Garrard RC70A Autochange Gram Unit ... £4 4 0
Collaro 3-speed Autochange Gram Unit ... £8 8 0
Garrard T 3-speed Unit, 2 Decca XMS Heads ... £10 10 0
Decca 2-speed Transcription Unit £7 7 0
B.S.R. GU4/M 3-speed Unit, less heads ... £4 17 6
Wharfedale W10CSB in baffle ... £12 12 0
Sound Sales Reflex Console Speaker ... £10 10 0
Goodmans 12in. high flux Axiom Unit ... £4 10 0
R.A. 8in. Unit with transformer ... 15 0
Wharfedale Bronze 10in. 2/3 ohms ... £3 10 0
Deccola 9-valve Amplifier, as new £19 19 0
R.D. Minor Amplifier, perfect ... £9 9 0
Gramophone Amplifier with preamp. ... £12 12 0
Acoustical QUAD I Amplifier and preamp. ... £23 2 0
Decca PA6 Amplifier, in metal case ... £15 15 0
Eddystone 5640 Communications Receiver, as new ... £25 4 0

R.D. Senior Amplifier £28 0 0
R.D. Senior Control Unit ... £15 0 0



R.D. Minor Amplifier, 3 watts output ... £12 17 6
R.D. Baby de Luxe Amplifier ... £14 0 0
R.D. Junior Mark II preamplifier ... £9 0 0

Hire Purchase Terms on new apparatus over £10—deposit, and balance over 6, 12 or 18 months.

Leak TL/12 amplifier, 12 watts output ... £28 7 0
Leak TL/10 amplifier, 10 watts output ... £17 17 0
Leak Point One preamplifier ... £10 10 0
Leak Varislope preamplifier ... £12 12 0
Acoustical QUAD Mark II amplifier ... £22 10 0
Acoustical QUAD Control unit... £19 10 0
Lowther Corner reproducer incorporating the P.M.3 drive unit £96 0 0
Wharfedale treble speaker assembly ... £72 0 0
Tannoy dual concentric 12in. corner speaker ... £48 6 0
Chapman FM81 V.H.F. Tuner ... £18 10 0
Chapman S.6 3-wave Tuner ... £30 0 0
Connoisseur 3-speed motor ... £23 8 11
Collaro 2000 transcription motor £13 9 6

Also complete stocks of **Wharfedale** and **Goodmans** speaker units, **Connoisseur**, **Decca** and **Leak** Pick Ups.

PART EXCHANGE OUR SPECIALITY—Write with details

- **T/V TECHNOLOGY**
- **RADIO ENGINEERING**
- **ELECTRONICS**
- **RADIO SERVICING**

FOR REDUCED SUMMER FEES USE COUPON NOW!

There's a big future in T/V and Radio. Act now! Increase your knowledge. Back up experience with a sound theoretical background. I.C.S. offer courses of instruction in—

T/V TECHNOLOGY ● ADVANCED SHORT-WAVE RADIO ● RADIO ENGINEERING ● RADIO SERVICE ENGINEERING ● RADAR ● ELEMENTARY ELECTRONICS.

I.C.S. will also coach you for the following examinations :— **B.I.R.E. ; P.M.G. Certificate for Wireless Operators ; Radio Servicing Certificate (R.T.E.B.) ; C. & G. Telecommunications, etc., etc.**

DON'T DELAY—SEND COUPON TODAY for free descriptive booklet, stating which subject or examination interests you. Fees include all books needed. Examination students coached until successful.

Dept. 223E, I.C.S., 71 Kingsway, W.C.2.

INTERNATIONAL CORRESPONDENCE SCHOOLS.
Dept. 223E, International Buildings, Kingsway, London, W.C.2.

I am interested in your special Summer Term offer.

Subject .....

Name ..... Age .....
(Block letters, please)

Address .....

.....

ICS

CO-AX PRECISION CONNECTORS

Better ON *all* COUNTS

- design
- machining
- performance
- price
- delivery

The most comprehensive range of **U.S. CONNECTORS outside the U.S.A.**

CO-AX Connectors
CO-AX Cables R.G. Cables
Microdual drives

TRANSRADIO LTD. 138A Cromwell Rd. London SW7. Tel: FRE.4421

The best of Tape Recorders – and an

INDEPENDENT P.A. AMPLIFIER *as well!*

★ **TO THE TRADE:** *Ask for details of special Dealer facilities and Information Sheet* T1/6

One of the many features of the SIMON Portable Tape Recorder is the provision of facilities for entirely independent use of the amplifier for public address, record reproduction, etc. at 10 watts output power.

This versatile and brilliant Recorder was designed for the user who expects—and appreciates—the best.

Two hours' recording time. Twin tracks, two speeds. Frequency response: 50-12,000 c/s at 7½in./sec. and 50-7,000 c/s at 3¾in./sec. Bass and treble independently variable.

SIZE	18 in. x 15 in. x 10 in.
LOUDSPEAKER	6½ in. built-in monitor
POWER SUPPLY	200/250v. 50 Cycles A.C.
INPUT CHANNELS ...	High impedance for microphone; low or high impedance for radio
POWER CONSUMPTION	100 watts approx.

Simon Portable TAPE RECORDER *Model SP/1*

★ *Monomaster "Fingertip" Control*
★ *Separate capstans*
★ *Three motor drive*
★ *Fast rewind and windon.*
★ *Provision for Remote Control.*
★ *Drop-in loading.*

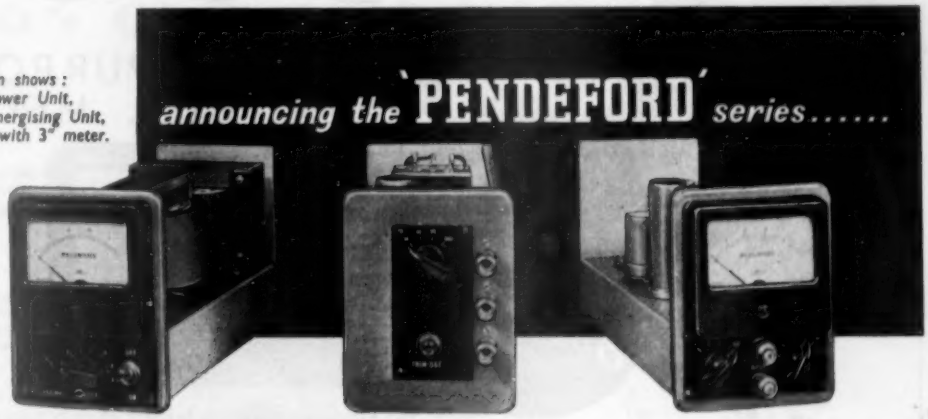
SIMON *for* ***Sound Recording*** *at a* ***Sensible Price***

Ask for
"THE GENTLE ART OF TAPESMANSHIP"
and Information Sheet T1/6

SIMON SOUND SERVICE LTD. (Dept. W)
48-50 GEORGE ST., LONDON, W.1. *Phone: WELbeck 2371 (5 lines)*

Illustration shows: Master Power Unit, Master Energising Unit, Indicator with 3" meter.

announcing the **'PENDEFORD'** *series.....*



A compact, versatile system of instrumentation for the measurement of force, load, displacement, thickness, pressure and weight—readily adaptable to your requirements from one to six channels with the utmost economy. A system of vital interest to users and makers of machine tools.
A complementary range of transducers and load cells is available.

Write today for further particulars.

BOULTON PAUL ELECTRONICS
BOULTON PAUL AIRCRAFT LTD.
WOLVERHAMPTON

Manufacturers of Six Channel C.R.T. Film Recorders, Transducers, Strain and Load Indicators, Load Cells, Integrators and Timers, Precision Automatic Manometers, Stabilised Power Supplies, etc.

Great Britain's Valve Mail-Order House

SALE (2,000 101 TYPES) VALVES FROM (post. 9d.) 2/-

Types and Prices subject to stock. We may send equivalents. When ordering cross (blank) postal order.

SERVICE SHEETS
The one you require enclosed if available in a dozen assorted of our best choice. **10/6**

TAYLOR METERS ON EASY TERMS

Model	Cash Price	Deposit	10 Monthly p'ments of	Total H.P. Price
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
20B	15 15 0	2 7 3	1 10 2	17 8 11
45B	35 10 0	3 18 6	2 8 9	39 4 0
66A	22 10 0	3 7 6	2 3 0	24 17 6
71A	12 10 0	1 17 6	1 4 0	13 17 6
72A	16 0 0	2 8 0	1 10 8	17 14 8
77A	15 0 0	2 5 0	1 9 3	16 11 3
88A	21 10 0	3 4 6	2 1 2	23 16 2
110C	14 10 0	2 3 6	1 7 9	16 1 0
120A	9 0 0	1 7 0	17 3	9 19 6
130A	15 0 0	2 5 0	1 8 8	16 11 8
170A	24 0 0	3 12 0	2 9 11	26 11 8
190A	22 10 0	3 7 6	2 9 0	24 17 6
240A	14 0 0	2 2 0	1 6 9	15 9 6
260A	36 15 0	5 10 3	3 10 4	40 13 7
520A	10 0 0	1 10 0	19 2	11 1 8
290A	29 10 0	4 8 6	2 16 5	32 12 8

HIVAC MIDGET AND SUB-MINIATURE VALVES

The opposite can be supplied for 2 volts at the same prices, also Type XV6 2.0 v. at 15/6.

MIDGET TYPES			SUB-MINIATURE TYPES		
X86	15/6	XL 10/6	XW9.75	17/6	XFY10 17/6
XW	15/6	XLO 10/6	XY1.4B	17/6	XFY11 17/6
XH	10/6	XP 12/6	XY1.4C	17/6	XFY12 17/6
XD	10/6	XY 15/6	XFW10	17/6	XP01 21/4

1E5	16/5	35Z5GT	12/-	ECL80	23/4
1R5	16/5	50L6GT	16/5	EF9	19/6
1T4	14/6	10	12/-	EF37A	22/1
3S4	14/6	22	13/3	EF39	16/5
3V4	14/6	80	13/3	EF40	22/1
01A	7/4	81	18/11	EF41	16/5
1A4	13/3	71A	6/10	EF50	22/1
1B4	13/3	112A	12/-	EF80	22/1
1P4	10/2	1A7GT	18/11	EF91	22/1
1E5G	12/-	1C5GT	14/6	EK32	22/6
1P5G	11/4	1H5GT	14/6	EL3(N)	20/2
1J6G	12/-	1N5GT	14/6	EL33	16/5
5Y3GT	13/3	3A4	18/11	EL37	22/1
6A4	15/1	3A8	21/6	EL38	25/2
6AL5	11/4	6X5G	13/3	EL41	16/5
6AQ5	16/5	1561(1W4)	13/3	EM1	16/5
6AT6	15/1	AZ1	13/3	EM4	16/5
6AU6	22/1	AZ31	13/3	EM34	16/5
6BA6	16/5	AZ50		GZ34(G)	18/6
6X4	13/3	(DW4)	13/3	EY51	25/2
6J6	31/6	CBL1	22/1	EZ40	13/3
6SA7GT	20/2	CL4	20/2	EZ41	13/3
6SK7GT	16/5	CY1	13/3	PY80	15/9
6SQ7GT	15/1	EB41	11/4	PY81	18/11
6V6GT	16/5	EB91		PY82	13/3
7E7	14/6	(6AL5)	11/4	PL81	22/1
12AT7	22/1	EBC33	15/1	PL82	16/5
12AU7	22/1	EBL1	22/1	UBC41	15/1
12AX7	22/1	EBF89	15/11	UBL21	20/2
12SA7GT	20/2	ECC40	22/1	UCH21	20/2
12SK7GT	16/5	ECH3	22/6	UF41	16/5
12SQ7GT	15/1	ECH35	20/2	UL41	16/5
25L6GT	16/5	ECH42	20/2	UY41	13/3

Post 9d. Lower Prices. One-Year Guarantee.

RADIO BULLS VALVES
246 HIGH ST. HARLESDEN NW10

Post 9d.			
01A	2/-	954	2/-
1B4	3/-	1177Z6	7/-
1H6	3/-	4TS8A	6/-
1LN5	7/-	4TS9P	5/-
2A6	2/-	138PA	5/-
2A7	3/-	71A	2/-
2B7	2/-	2028TH	3/-
6F7	6/-	215P	2/-
12A	2/-	220PT	4/-
128P5	6/-	ACHLDDD	6/-
31	2/-	EF6	17/6
34	3/-	P2	3/-
48	4/-	P215	2/-
50Y6	8/-	PM24A	7/6
		PX25	10/-

2/3 "DEMOBBED VALVES MANUAL" 2/6
Giving equivalents of British and American Service and Cross Reference of Commercial Types with an Appendix of B.V.A. Equivalents and Comprehensive Price List. We have still some Valves left at very old Budget Rates (33⅓%).

ROD Antennae, 4ft. sections, interlocking and extending, copper plated steel. BARGAIN 2/6 doz.

TYANA TRIPLE THREE
Small Soldering Iron. Latest development. Complete with detachable bench stand. Post 1/-. **19/6**

BIB The new 3 in one Tool. Strips insulation without "nicking" wire. Cuts wire—no rough edges. Splits flex. **3/6**

Deposit and Monthly **10/-**
AC ELECTRIC PAINT SPRAYER
Just plug in and spray. Easier than a brush and twice as fast. 75/-, post 2/-. With THREE ceiling adaptors.

Tax Free

BLACK & DECKER
HANDY-UTILITY ¼in. Portable Electric **DRILL.**
Deposit £2
CASH PRICE £5/10/6 **10/6**
or 9 easy payments. Monthly

FULL LIST STAMP

The High Quality Portable "ELIZABETHAN" Tape Recorder 2 Speed.
Recording medium standard ¼in. plastic coated tape. Tape speeds, 7½in. and 3¾in. per second. Running time, 60 or 90 minutes. Rewind, 60 seconds. Frequency range, 40 c.p.s.-10 Kc. at 7½in. per second. Loudspeaker, 6in. Moving Coil. Output, 3 watts. Mains supply, 200-250 A.C., 50 c.p.s. Mains consumption, 60 watts. Dimensions, 16½in. × 13½in. × 8½in. Weight, 35lb. Supp. with crystal mic. and 1,200ft. of tape. Fully guaranteed.

DESIGNED to have many uses, THE "ELIZABETHAN" features these points:—
Twin track recording, doubles playing time per reel. Fast forward and rewind. Separate mic. and gram inputs. Separate amplifier position to enable use as high quality amplifier for disc record players and R.F. units. CUEING STRIP for ease in finding recorded information or music. No splicing of tape. "MAGIC EYE" recording level indicator. Variable tone control for playback. Provision for Ext. L/S. **TERMS:** Deposit £16/16/-, balance in 12 monthly instalments of £3/4/5, or 48 ens. Cash.

INSULATED SLEEVING

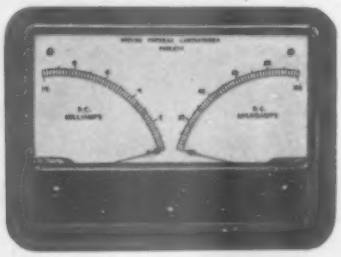
Heat, shock and moisture proof. Diameters from 0.5 mm. to 30 mm. in 36" lengths. It is manufactured in all colours and bi-colours.

SPICERS LIMITED

19 New Bridge St., London, E.C.4. Tel.: CENtral 4211

High Sensitivity

DOUBLE PURPOSE METER



★ *PANEL MOUNTING*

Moving Coil Ranges from 15μA

Moving Iron Ranges from 5 Milliamps

Movements are independent of each other and any two ranges may be incorporated. Panel space is saved and it enables more convenient observation of inter-dependent electrical quantities. Send for prices and full specification.

BRITISH PHYSICAL LABORATORIES

RADLETT, HERTS. Tel.: Radlett 5674/5/6

London Stockist :
M. R. Supplies Ltd., 68 New Oxford Street, W.C.1

dm BP 21

14 reasons why *those concerned with recorded sound choose*

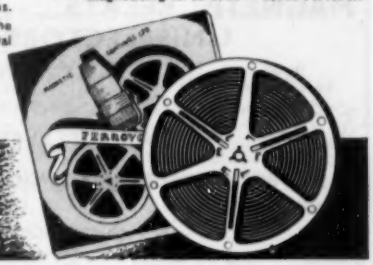
FERROVOICE

MAGNETIC RECORDING TAPE

1. Does not curl—lies flat on the transducer head, giving better frequency response, and smooth tracking.
2. Has the lowest possible surface friction—reducing wear on transducer heads, and guide pillars.
3. Has the best possible dispersion of oxide particles, free from coagulation, and flocculation ensuring low noise level.
4. Is correctly heat-dried to preclude "blocking" and sticking, layer-to-layer, under storage conditions.
5. The Lacquer is formulated to attain the maximum adhesion to the base material.
6. Gives the highest possible signal-to-noise ratio—excelling in high-frequency response.
7. Has a superlative dimensional stability—negligible stretch, and the highest possible tensile strength.
8. Discourages static collection during fast forward, and fast re-wind operations.
9. The Kraft Paper base has been selected after careful development with the paper manufacturers—flexibility, and super-calendering being prime considerations.
10. The Lacquers are pigmented with the highest grade powder. The individual particle size is less tha one micron (0.000039 inch).
11. The pigment is dispersed and milled, with the highest degree of control, thus ensuring a uniform dispersion of the oxide particles within the binder.
12. The spools were designed to incorporate the "universal" hub, perfect balance, and negligible rotation noise.
13. "FERROVOICE" products are subject to continuous development by our technical staff.
14. "FERROVOICE" has a Coercivity of 270 oersteds (BHC) remanence = 730 gauss, when subjected initially to a magnetising force of H = 2,000 oersteds.

Suitable for Single or Double Track Recording. Length 1,200ft. on 7in. Diameter Spool—Frequency response 50 C.P.S. to 10 kc/s. at 7.5 in. per sec. Breaking strain exceeds 4lb.

22/6 RETAIL PRICE



MAGNETIC COATINGS LIMITED

38 GROSVENOR GARDENS LONDON SW1 Telephone: SLOANE 9129

WORKS & LABORATORY: 25 DAGHWOOD TRADING ESTATE
LARCH ROAD LONDON SW12 BALHAM 5579

If it's Components——

ACOS
ADCOLA
AERIALITE
ALLEN
AMPLION
ARROW
AVO
BELLING LEE
BRANDENBURG
BRIMAR
BSR
BULGIN
CELESTION
CINCH
COLVERN
COSSOR
CYLDON
DENCO
EDISWAN
EGEN
ELAC
ELLISON
ELSTONE
GARRARD
GOLDRING
GOODMANS
GRAMPIAN
HAYNES
HUNTS
JACKSON

LAB
LONG & HAMBLY
MARCONI
MAZDA
McMURDO
MORGANITE
MOTEK
MULLARD
MULTICORE
NERA
NORMAN PRICE
OSMOR
PARTRIDGE
PHILIPS
PIFCO
'Q' MAX
ROLA
SCOTCH BOY
SEN TER CEL
SOLON
TAYLOR
T.C.C.
TRUVOX
VIEWMASTER
W.B.
WEARITE
WESTINGHOUSE
WEYMOUTH
WHARFEDALE
WOLF

Write now for

CATALOGUE NO. 12 PRICE 1/-
● 70 PAGES ● 250 ILLUSTRATIONS

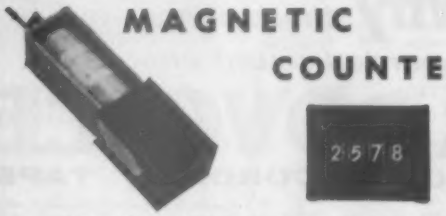
RADIO SERVICING CO.

EALing 5737

82 SOUTH EALING ROAD, LONDON, W.5.

Next to Sth. Ealing Tube Station

ELECTRO-MAGNETIC COUNTER



MAJOR TYPE 6 × 1½ × 1¼ ins.
FOUR FIGURES
TWO TYPES
3 ohms operates on 3/6 Vo. D.C.
500 ohms operates on 18/24 Vo. D.C.
17/6 Post & Pkg. 9d.

MAGNETIC RELAYS
UNISELECTORS
KEY SWITCHES

JACK DAVIS (RELAYS) LTD.
36 PERCY STREET · LONDON · W.1
MUSEUM 7960 LANGHAM 4821

THE EDDYSTONE MODEL 740

A British made Communications Receiver of the highest quality and sensitivity at a moderate price.

£43/15/- (H.P. Terms Available)

6 B8A valves comprising R.F. Amplifier, Frequency Changer, I.F. Amplifier and A.G.C., A.F. Amplifier and Detector, Output, B.F.O. Noise Limiter and Full Wave Rectifier.

TUNING RANGE

Range 1. 30.6 Mc/s to 10.5 Mc/s.
Range 2. 10.6 Mc/s to 3.7 Mc/s.
Range 3. 3.8 Mc/s to 1.4 Mc/s.
Range 4. 205 Metres to 620 Metres.

Accuracy of better than 0.5%. Range 4 includes the International Distress Wave.

GENERAL CONSTRUCTION

Aluminium diecastings are used for the front panel and tuner unit chassis. The cover is of steel, fitted with lift-up lid and thoroughly rust-proofed. Tropically finished component parts.

POWER SUPPLY. 110 volts and 200/240 A.C. only. Or From 6 volts with external vibrator unit.

Further technical details of this or any other Eddystone Receiver gladly supplied on request.
Latest Eddystone Components Catalogue 1/-.

HP RADIO SERVICES LTD.,
The Eddystone Specialists
55 COUNTY ROAD, LIVERPOOL, 4
Telephone: AINTREE 1445 *ESTAB. 1935*

POLYTHENE
H. F. EQUIPMENT
(AMBYTHENE BRAND)
COIL FORMERS
CHOKES
STAND-OFFS
FEED-THROUGHS
Send for particulars and Samples
AMPLEX APPLIANCES (KENT) LTD.
19 DARTMOUTH ROAD, HAYES, BROMLEY, KENT
(RAVensbourne 5531)
All export enquiries to
ANTEX LTD., 3, TOWER HILL, LONDON, E.C.3

BELCLERE
MINIATURE
STANDARD INPUT TRANSFORMER

Small, efficient, low priced, size 1in. x ⅝in. x ⅝in. overall as illustrated. Uses: For coupling inputs of 3-150 ohms to normal type pentode valves. Specification: Ratio 1-50, Primary 3.5 ohms. Secondary inductance 160 H. at 1,000 c.p.s. Range 6½ octaves ± 2 db. Finish varnish dip, encapsulated block or mu-metal screening can. *Quick delivery—low price—maximum efficiency.*
JOHN BELL & CROYDON 117 HIGH STREET, OXFORD
Telephone: 47072. Cables: Belclere, Oxford.

Television · Radio · Record
CABINETS MADE TO ORDER
ANY SIZE OR FINISH
CALL OR SEND DRAWINGS FOR QUOTATION
B. KOSKIE (DEPT. E.)
72-76 Leather Lane, Holborn, E.C.1
Phone: CHAncery 6791/2

H. WHITAKER G3SJ.,
10, YORKSHIRE STREET, BURNLEY

Manufacturers of precision Quartz Crystals, for frequency control, in a wide variety of bases, covering all Aircraft, Shipping and Amateur frequencies. All are made to extremely fine tolerances, and have an activity pass figure as good or better than Government standard for the frequency. In addition we can undertake the calibration of your own crystals and supply certificates at nominal cost. Regrind service: Your redundant crystals can be reground to new frequencies at an average cost of 7/6 to 10/-, depending on tolerance, or taken in part exchange. Early deliveries can be given on all types. Regrind service 7 days approx.

H. Whitaker G3SJ. *Contractors to the War Office, Air Ministry, Post Office and Government Departments the world over.*

THE ELPICO *Impresario*

COMPLETE ENTERTAINER

(Patents applied for)

TAPE RECORDER

The "Impresario" is a combination instrument that will make high quality tape recordings of live speech or Music, Gramophone recordings or Radio Programmes and Telephone conversations, etc.

- Dual speed 3¾/7½in. per sec.
- Twin track: up to 2 hrs. recording.
- Separate bass and treble controls.
- 4 watts Output: Neg. F/B.
- Internal mike recording system.

PRICE **49½** GNS.
(EXCLUDING TAPE)

The "Impresario" can also be used as a high quality Radio, Gramophone or Microphone Amplifier.

GUARANTEED FOR 12 MONTHS

RADIO RECEIVER

Distortionless Superhet 3 wave radio tuner unit.

The "Impresario" is the first Transportable Tape Recorder in Great Britain to provide power supply and internal space for a Radio Tuner Unit with optional listening and/or recording. *May be fitted in a few minutes.*

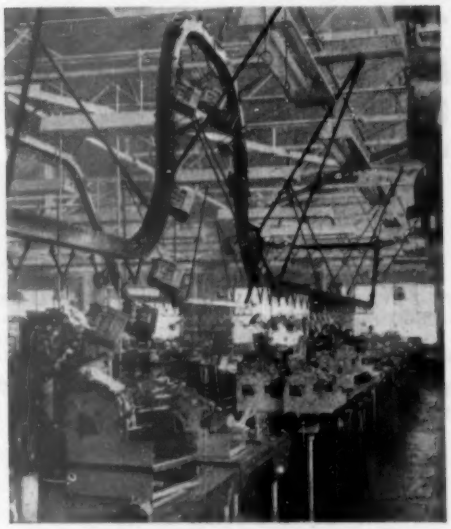
Price **14** Gn
Tax Paid

Send for "Impresario" illustrated Brochure which also contains details of Radio Tuner Unit, Telephone Pick-up, suitable Microphones and Recording Tape.

PIEZO-ELECTRIC MICROPHONES

Hand Unit in Rubber Grip	3 gns.
Studio Floor Stand Pattern	6 gns.
Telephone Pick-up Stand	3 gns.

LEE PRODUCTS (GT. BRITAIN) LIMITED
ELPICO HOUSE, GT. EASTERN STREET, LONDON, E.C.2



A large-scale, P.C.P. installation made at the works of the National Cash Register Co., Ltd., Dundee. All you need to fit it are a hacksaw, a clamp and a spanner.

MECHANICAL AIDS TO PRODUCTIVITY

OVERHEAD MOVEMENTS MEAN LOW OVERHEADS

Not all mechanical handling systems require expert fitting! Here's one you can install yourself—a low cost, overhead chain conveyor giving greater output and higher efficiency.

Every month, MECHANICAL HANDLING—the only British journal devoted entirely to the subject—describes and illustrates the latest labour-aiding devices, and shows how they are being used to increase production and cut costs. *There's a system for YOU in your business.* Take the first step to increase production . . . place a regular order for MECHANICAL HANDLING *now!*

TO W.W.6

MECHANICAL HANDLING
DORSET HOUSE · STAMFORD STREET · LONDON S.E.1

Please enter my name as a subscriber for the next 12 issues. I enclose remittance value £1 15s. (U.S.A. $5.50, Canada $5.00.)
Remittances from overseas should be made by money order or bank draft in sterling on London out of a registered account.

Name .....

Address .....

..... Date.....

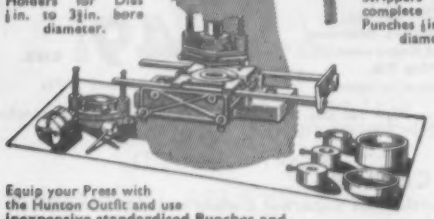
POST THIS FORM TODAY

REDUCE YOUR PRESS TOOL COSTS

THE HUNTON UNIVERSAL BOLSTER OUTFIT FOR SHEET METAL PIERCING AND BLANKING ON FLY PRESSES

Bolster Frame with 2 adjustable gauges and insertable steel Holders for Dies ¼in. to 3½in. bore diameter.

Two Punch Holders with detachable positive-action Strippers take the complete range of Punches ¼in. to 3½in. diameter.



Equip your Press with the Hunton Outfit and use **inexpensive standardised Punches and Dies ¼in. to 3½in. diameter, obtainable from stock—in ¼in. sizes—when required.**

Standardised Tools also available at short notice for Square, Oblong and other shapes, Louvre Forming (up to 8in. long), Corner Notching, Corner Radiusing, Angle Iron Notching and Piercing, etc.

Get the Outfit now—Buy Punches, Dies and Tools as you need them

Descriptive brochure and prices on request.

HUNTON LIMITED

Phoenix Works, 114-116, Euston Road, London, N.W.1

Telephone EUSton 1477-8-9 *Telegrams:* Untonexh, London.

HANNEY of BATH offers:

WILLIAMSON AMPLIFIER. Woden potted components. Output trans. WOT.25 (U.T.D), 120/-; PIM. 14a. mains trans., 87/6; PCF.12 150 mA. choke, 44/-; PCF.22 30H 20 mA. choke, 20/-; PIM 23 (mains trans. for pre-amp.), 47/6. Resistor (RK) and Condenser kits (CK) available, RK, main amplifier, 29/6; RK, figs. 13 and 27, 12/6; RK, fig 15, 28/9; RK fig. 19, 36/-; RK fig. 29, 29/3; CK fig. 13, 15/-; CK. fig. 15, 47/-; CK fig. 19, 54/6; CK fig. 27, 19/-; CK. fig. 29, 54/6. 12 1% silver micas (Fig. 19), 15/-; 7 5%, 7/-. Elstone output trans., 90/-; mains trans., 87/6; 1 OH 150 mA. choke, 20/-; 30H, 30 mA. choke, 10/-.

VIEWMASTER IN EASY STAGES. Constructor's Envelope, 7/6. Stage 1, 82/3; two, 47/9; three, 65/1/6; four, 9/10; five, £10/4/-; six, £7/7/3; seven, 64/-. Complete pre-amp. kit (less valve), 32/2.

WB100 (sound and vision chassis), 19/6; WB101, 6/-; WB102, 19/6; WB103, 42/-; WB203A, 59/6; WA104, 15/6; WB105, 47/3; WB106, 25/6; WB107, 32/6; WB108, 33/3; WB109/1, 2 or 3 (state tube type), 22/6; WB110, 10/-; WB112, 21/6; WB Console conversion kit, 35/-; WB200 pre-amp. chassis, 17/6; Westinghouse Rectifiers, 14A86, 20/4; 14D86, 11/7; WX3 and WX6, 3/9 each; 36EHT100, 20/5; 36 EHT50, 26/1; 36EHT45, 23/5; K3/100, 14/8; K3/50, 8/9; K3/45, 8/3. T.C.C. Condensers, £7/10/- (any condenser supplied separately). Morganite pots, 5/- each; Morganite resistors, 35/1. Colvern pots, 22/6; or CLR901, 3/3 each and CLR4089/22, 6/4. Belling-Lee L707, 8/9. Fuses, 6d. each. Wearite Collets (with L9), L'don and Belfast, 22/-. Wenvoe and Pontop Pike, 28/-; H. Moss, K-o-S, B'ham and Brighton, 30/-; Pre-amp. coils, 4/- pr. (any channel).

WIDE ANGLE VIEWMASTER CONVERSION. Complete set of parts for converting existing Viewmaster to W.A., less valves, tube and mask, £14/19/6. W.A. Conversion instructions, 3/6; WB.113, 48/6; WB114, 23/6; WB115, 42/-; WB116 and WB117, 7/6 each; WB118, 22/6; WB119, 26/9; WB121, 3/6; WB134, 10/6; Westinghouse 36/EHT/30, 17/-. Plus condensers and resistors as per our general list.

MULLARD "UNIVERSAL" LARGE SCREEN A.C./D.C. TELEVISOR. Denco drilled chassis with all mechanical parts, 53/6; FD12/4 duomag focaliser, 37/6; 14A/342 rectifiers, 37/2; Goldsman droppers DK37/6, 8/9; DK35/6, 7/6. VA1006 varite res., 4/6. Other Denco parts, please see below.

WIDE ANGLE COMPONENTS. ALLEN. Teleking Chassis, 50/-; Collsets (TK & Super-Visor), 44/6; LO.306, 40/-; FO.306, 31/-; DC.306c., 39/6; FC.302, 31/-; GL.16 & 18, 7/6 each; SC.312, 21/-; AT.310, 30/-; OP.117, 9/-; ST.314, 15/-; DENCO Chassis Magnaview, 37/6; Chassis, Super-Visor, 51/6; Collsets, Magnaview, 41/9; WA/DCA1, 43/-; WA/FCA1, 31/-; WA/LC1 & WC1, 7/6 each; WA/FMA1, 21/-; WA/LOT1, 42/-; WA/VBT1, 10/-.

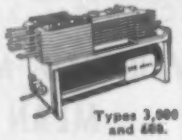
Send 6d. stamps for our General List of components for Viewmaster, Soundmaster, Williamson Amplifier, Teleking, Magnaview (Brimar & English Electric large screen TV), Super-Visor, Mullard Universal, Close tolerance Silver Micas, etc., etc. Please add 1/- postage to orders under £1.

L. F. HANNEY

77, LOWER BRISTOL ROAD, BATH

Tel.: 3811

RELAYS



BUILT TO SPECIFICATION. Types 3,000 and 600.

COIL WINDING AND TROPICALIZING.

KEY SWITCHES AND TELEPHONE EQUIPMENT.

Send for Price List or quotation.

UNIVERSAL ENGINEERING CO. (M.W.W.)

Havelock Works, Havelock Place, Harrow, Middlesex.

HAR. 1432.

TRANSFORMERS
COILS
CHOKES

LARGE OR SMALL QUANTITIES

TRADE ENQUIRIES WELCOMED

SPECIALISTS IN

FINE WIRE WINDINGS

MINIATURE TRANSFORMERS, PICK-UP, CLOCK AND INSTRUMENT COILS, ETC.
VACUUM IMPREGNATION TO APPROVED STANDARDS

ELECTRO-WINDS LTD.

CONTRACTORS TO G.P.O., M.O.S., L.E.B., ETC.

123-5-7 PARCHMORE ROAD, THORNTON HEATH, SURREY

LIVINGSTONE 2261 EST. 1933

THE WORLD'S GREATEST BOOKSHOP

FOYLES

FOR BOOKS

All the Books available on day of publication.
Secondhand and rare Books on every subject.
Stock of over three million volumes.

Subscriptions taken for magazines.

Foyles have depts. for Gramophone Records, Handicraft Materials, Stationery, Music.

119-125 CHARING CROSS ROAD, LONDON, W.C.2

Gerrard 5660 (16 lines) ★ *Open 9-6 (Thurs. 9-7)*

Nearest Station: Tottenham Court Road

L · H · F

The HI-FI Centre for the NORTH

Every facility for the Audio-Enthusiast

FULL RANGE OF AMPLIFIERS

"QUAD II" "LEAK TL/10" "WILLIAMSON"
"CONNOISSEUR" "WIDEBAND" etc.

RADIO TUNER UNITS

LOUDSPEAKERS of all high grade makes supplied. Acoustically correct CABINETS from stock, or made to specification by craftsmen.

GRAM MOTORS, PICK-UPS, AUTO-CHANGERS
by "Garrard" "Collaro" "Decca" and others

Demonstrations in our showrooms daily from 10 a.m. to 6 p.m.
Sats. 10 a.m. to 2 p.m. Expert advice on Audio matters.

LANCASTER HI-FIDELITY (LHF) ACOUSTICAL EQUIPMENT CO.
27/29/31 LANCASTER AVENUE, FENNEL ST., MANCHESTER, 4

★ For the convenience of out-of-town visitors our showrooms are very near Victoria Sta.

20 to 200~ 200~ to 2 Kc/s 2 to 20 Kc/s 20 to 200 Kc/s

LOW FREQUENCY SIGNAL GENERATOR

WHEN YOU CONSIDER the enormous frequency range of this instrument (10,000–1) we feel you must agree that it represents quite outstanding value at its very modest price. *" Providing " you will say " it is all you claim it to be."*

OF COURSE. We say that this instrument is good, but let the specification speak; hyperbole cannot enhance facts. The workmanship is sound and, where necessary, robust—we have a hard experience of sending many thousands of our instruments on long postal journeys. The mechanical design and layout are, we think, eminently practical—knobs where you want them and a desk type cabinet which removes the backache from scale reading.

We make no claims for our instruments which are not true, and if you wonder why the price is so low we can give the reason. We make instruments and sell them direct to the user—*it is as simple as that!*

- R-C Wien Bridge oscillator circuit with automatic amplitude stabilisation.
- Buffer amplifier protects oscillator from effects of varying external loads.
- Cathode-follower output stage.
- Frequency coverage 20~ to 200 Kc/s., in four decade ranges.
- Sine wave output with less than 1% distortion.
- Output power and voltage: 0.1 watt into 600 ohms or 10 volts across 5,000 ohms.
- A.C. mains operation—110 and 200-250 volts 50-100~.

Call and inspect this instrument (we are open until 12.30 p.m. on Saturdays) or send for full technical details. Our range includes **SIGNAL GENERATORS ● PATTERN GENERATORS ● CALIBRATED VARIABLE CONDENSERS ● SUBSTITUTION BOXES.**

PRICE £15-15-0

or £5-5-0 deposit and 6 monthly payments of £2-2-0

(postage and packing 5/- extra)

EXPORT ENQUIRIES WELCOMED

HOMELAB INSTRUMENTS LTD., 615-617, HIGH ROAD, LONDON, E.10

Telephone: LEY 5651 *Telegrams*: HOMELAB, LEYSTONE, LONDON. *Cables*: HOMELAB, LONDON

AGENTS FOR THE

'Astronic'

RANGE OF AMPLIFIERS

A 1254C 12 Watts High Fidelity AC Mains. *(As illustrated.)*	£26/5/0
A 1258 Tone Corrector unit for A 1254C. *(As illustrated.)*	£11/11/0
A 1261/T 30 Watts Portable AC Mains.	£36/15/0
A 1266/T 12 Volt Power unit for A1261/T.	£12/18/6
1267/T 40 Watts Portable AC Mains or Battery.	£48/6/0

SOUTHERN ENGLAND AGENTS

for

Birmingham Sound Reproducers Ltd.

Styli, Matching Transformers and spares for The Monarch and Regent Gramophone Units.

Special Amplifiers, Transformers, Chokes and Laboratory Apparatus. A full range of Microphones and Loudspeakers available. For superb reproduction of gramophone records use the Monarch or Regent and A 1254C. Obtain details from your local retailer or wholesaler. In case of difficulty and all overseas enquiries, write to " Dept. AB " at the address below.

N. MIERS & CO. LTD., 115 Gower Street, London, W.C.1

Telephone: EUSton 7515. Cables: MIERSCO.

G.W. SMITH & Co.

(RADIO) LIMITED

Pye 45 Meg Television I.F. Strip, complete with 6 EF50 and 1 EA50 valves. 69/6 each.
Sprague Condensers. .1 mfd., .01 mfd., .02 mfd., .05 mfd., .005 mfd., Wire Ends, 9d. each.
Burgess Microswitches, universal type change over, size 2in. x ¾in. x ½in., 3/6 each.
Desk Type 0-1 mA. Moving Coil Meters. 2½in. scale reading, 25/- each, brand new. 0-15 volt A.C. meters 2½in. scale reading, brand new 9/6 each.
Nitrogel Condensers. 4 mfd. 4,000 volt working, size 9in. x 5in. x 3½in., brand new, 22/6 each. Paper Mansbridge condensers, 4 mfd. 2,000 volt working. Size : 5in. x 5in. x 2½in., 7/6 each.
A.C. Mains Transformers. 230 volt 50 cycle input. Output 1,500 volts 300 mA. Size : 7½in. x 6in. x 6in., 69/6 each.
American Rotary Transformers. 12 volts D.C. input. Output 255 volt at 65 mA. Size : 4½in. x 2½in. For Car Radio operation. Also suitable for running Electric Shavers from your car supply, 22/6 each. Brand new.
Muirhead Switches. Precision built. 8 pole 2 way. Key switch action, brand new, boxed, heavy contacts, 4/6 each.
Ceramic Transmitter Switches. With extra heavy duty silver-plated contacts, 3 bank single pole 6 way, spacing between contacts 1in. spacing between wafers 1½in. and 5in., 9/6 each.
Mains Isolation Transformers for industrial purposes. 230 volt A.C. 50 cycles input. Output 230 volt 50 cycle 1,000 watts supplied complete in heavy duty metal case size 13in. x 10½in. x 8in. Price £6/10/-.
Smoothing Chokes. Heavy duty. 20 Henry 300 mA., 2,000 volt insulation test. Admiralty rating will pass 500 mA., 13/6 each
Mains Transformers. 230 volt Primary, Secondary 500 x 500 at 170 mA, 4 volt 4 amp. C.T. W.D. rating insulation test 3,000 volts. Ample space for additional 6.3 winding if required, 22/6.
H.R.O. 6 volt Vibrator Power Packs. Output 165 volt 80 mA. 6.3 volt at 3 amps., 6 x 5 rectifier. Choke condensers smoothed, complete in self-contained crackle cabinet size 7in. x 7½in. x 6in., battery leads with croc. clips supplied. Brand new, 29/6.
Ceramic Switches. Standard spacing, 4 pole 3 way 3 bank. Special price 6/6 each. Brand new and boxed.
Smoothing Chokes. Ex-W.D. 15 Henry at 275 mA. Ministry rating, resistance 125 ohms, 10/6 each.
Meter Switches. Standard Yaxley Wafer Type, 8 bank, single pole 9 way, 11 way or 12 way. Size 2½in. diameter, switch length 5½in. plus spindle, 2½in. Price 7/6 each.
Microamp Meters. 0-100 Microamps, 2½in. Flush Panel Mounting scaled 0-1,500 yards. Brand new and boxed, 42/6 each.
Rotary Converters. 24 volt D.C. input. Output 230 volt A.C. mains 50 cycles at 100 watts. 92/6 each, ditto 12 volt input, 92/6.
Midget 18 Way Moulded Plugs and Sockets. Non-reversible. Size 2in. x ¾in., 3/6 pair.
Chokes. Heavy duty ex-W.D. 20 Henry 120 mA., size 3in. x 4in. x 2½in., 10/6 each.
Power Packs, Type S441, 8 input voltage 200/250, 50 cycles A.C. Outputs 300 volts 200 mA., L.T. 12 volt 3 amp., also separate 12 volt 1 amp. supply operating built-in Londex overload relay, with 5U4G valve. Supplied in grey mottled cabinet size 13½in. x 7½in. x 6½in., 62/6 each.
Multi Way Switch Boxes, ex bomb release, fitted with 16 toggle switches, ideal for model control, brand new and boxed, 9/6 each.
Swinging Chokes. Parmeko. 150 mA. 4.2/20 Henry, size 3in. x 3in. x 3½in., 7/6 each.
Ex Am. Switch Boxes. Moulded bakelite. Totally enclosed. 3-way, 1/9 each ; 5-way, 3/6 each.
A.C. Mains Transformers, ex-Admiralty, input voltage 100/250 A.C. at 50 cycles, outputs 670 x 670 volt at 200 mA., 6.3 volt 4 amp., 5 volt 3 amp., 49/6 each.
P.O. Automatic Telephone Circuit Diallers, Type 1, 25 bank, Type 2, 50 bank, 7/6 each. These precision built units have hundreds of potential uses, each one being fitted with clockwork control motor.
R.1155 2-speed Slow Motion Motor Drives. "A" type with double knots, 4/- each.
Amplifier Cabinets. Ex-well-known manufacturer, sloping desk type, well constructed with ventilated cover, chassis drilled for 5 l/o holders, size 13in. x 9in. x 7in. Sprayed attractive yellow. 15/6 each.
R.1155 Receivers, used models, aerial tested, and in perfect working order, complete with valves, £7/19/6 each.
A.C. Voltmeters. BSI grade, reading 0-300 volts at 50 cycles, 3½in. flush panel mounting, supplied complete with leads and case, 39/6 each.
Uniselector Switches. 4 bank double wiper, 32/6 each ; ditto 8 bank, 45/- each.
Hand Sets. Standard P.O. telephone type, 12/6 each.
Ceramic Switches. 3 pole 4 way 4 bank, standard size wafer, 10/6 each.
P.O. Magnetic Counters, supplied with coils, 2,300 ohms or 3 ohms, 10/6 each.
Please print your name and address clearly, also include postage or carriage on all items.

Hours of Business : 9 a.m.-6 p.m., excluding Thursday 1 p.m. Open all day Saturday.

G. W. SMITH & CO., (RADIO) LTD.
3-34 Lisle Street, London, W.C.2
Telephone: Gerrard 8204/9155
Nearest Tube Stations : Piccadilly or Leicester Square.

SPECIAL THIS MONTH!

We are able to offer the following

HIGH STABILITY RESISTORS

made by world famous manufacturers

170Ω	5%	½ Watt		10KΩ	1%	½ Watt
240Ω	5%	½ ,,		12KΩ	1%	½ ,,
360Ω	5%	½ ,,		20KΩ	1%	½ ,,
320Ω	1%	½ ,,		20KΩ	5%	½ ,,
330Ω	5%	½ ,,		25KΩ	5%	½ ,,
420Ω	5%	½ ,,		30KΩ	5%	½ ,,
825Ω	1%	½ ,,		150KΩ	5%	½ ,,
1390Ω	1%	½ ,,		193KΩ	1%	½ ,,
2000Ω	5%	2 ,,		193KΩ	5%	½ ,,
2290Ω	5%	½ ,,		200KΩ	1%	½ ,,
2500Ω	1%	½ ,,		450KΩ	1%	½ ,,
2650Ω	1%	½ ,,		510KΩ	1%	½ ,,
3600Ω	5%	½ ,,		510KΩ	1%	½ ,,
4700Ω	1%	½ ,,		1 MegΩ	20%	½ ,,
5100Ω	5%	2 ,,		2 MegΩ	5%	½ ,,
9250Ω	1%	½ ,,				

AT THESE VERY LOW PRICES.
¼ watt, ½ watt, 5% at 6/- doz., ¼ watt 5% at 7/6 doz., ¼ watt, ½ watt 1% at 7/6 doz., 1 watt 1% at 9/- doz., 2 watt 5% at 12/- doz.
VALVEHOLDERS. B9A CERAMIC with screening cans at 1/3 each. International Octal (Ex-Govt. but BRAND NEW) at 4/6 doz. Ceramic B9G (EF80) at 9d. each, 9/6 doz.
INDICATOR UNIT TYPE 157. Has same line up as INDICATOR TYPE 62: viz.: VCR97 C.R.T. mask, and Mu screen, 16-SP61, 2-EB34, 4-EA50 valves. 15 potentiometers, resistors, condensers, Muirhead S.M. dial, etc. BRAND NEW IN TRANSIT CASE. Price £3/7/6, plus 7/6 carr.
R.F. UNITS TYPE 25. Covering 50 to 65 mc/s. Complete with all valves. Brand new in cartons. Price 35/-, plus 2/6 post. Also R.F. UNITS TYPE 24. Complete with valves. Slightly soiled on outside. Price 14/6 each, plus 2/6 post.
MAINS TRANSFORMER FOR THE POWER PACK FOR THE 1132A OR 1155A RECEIVER. Input: 200-210-230-230-240-250 v. Output: 200-0-200 v. 150 mA., OR 250-0-250 v. 150 mA., 6.3 v. 6.5 amp., 6 v. 2 amp. These transformers are brand new and we offer them at the very low price of 19/6 each, plus 2/6 post.
MAINS TRANSFORMERS (slightly sub-standard). Input: 200-250 v. Output: 250-0-250 v. 60 mA., 6.3 v. 1.5 amp., 6.3 v. 1.5 amp. (tapped 5 v.). Price 7/6 each, plus 1/6 post.
SMOOTHING CHOKES. 16 Henries 60 mA. Size 3" x 2" x 1¾". Ideal for small receivers, power packs etc. 4/6 each, plus 1/- post.
MU METAL SCREENS for VCR97, VCR517 C.R. Tubes, etc. Price 6/6 each, plus post.
R.F. MONITOR TYPE 114. With 2 EF50 valves and EA50 Diode, mounted on neat chassis, 4in. x 4½in. Price 13/6, plus 1/6 post.
RUBBER MASKS FOR 12in. C.R. TUBES, at 3/6 each, plus 1/- post.
COIL FORMERS. Manufacturing type. ¾" with cores wound to T.V. frequencies, 2/6 doz.
AMPLIFIER UNIT TYPE A1271. Containing EF36 valve, 400Ω relay (4 makes, 2 breaks), 10,000Ω Pot., resistors, condensers, etc. In black metal case 5in. x 5in. x 5in. Brand new, at 7/6 each, plus 1/6 post.
194 I.F. STRIP. The well known I.F. Strip for T.V. conversion. Complete with 6-VR65, 1-VR66 (EA50), VR55 valves. A few only available at 35/- each, plus 2/6 postage.
ROMAC VACUUM PUMP (Rotary Vane Type). Ideal where air pressure is required, viz., paint sprayers, etc. Brand new at 15/- each, plus 2/- post.
BOMBSIGHT COMPUTOR MARK XIV. With 2 24-volt AC/DC motors, a 24-volt repeater motor, gyro unit, dozens of gear wheels, and anaroids, etc. Ideal for model makers, etc. Brand new in cases (the cases are worth at least 15/-). Price 37/6 each, plus 7/6 carriage.
ELECTRONIC INSULATION TEST SET AND NULL INDICATOR. This instrument uses a cathode ray visual indicator, and will test insulation, of up to 500 megohms, of condensers of any capacity (not electrolytic). Can also be used to check transformer windings, tag boards, valve bases, R.F. circuits, etc. If connected to A.V.C. (A.G.G.) line of receivers will serve as a sensitive alignment indicator. With an input impedance of 3.5 megohms it will serve as a sensitive null indicator. For use on 200-250 v. A.C. supply. Size 6¼" x 5¼" x 5". Price 37/6 each, plus 2/6 post.
SANGAMO MOTOR UNITS. These are brand new pre-paid meter movements with dozens of gears and a Sangamo-Weston 200-250 v. A.C. 50 cycle motor (silent running). Has numerous applications (clockmaking, etc.). Price 10/6 each, plus 1/3 post.
ELECTRONIC COUNTER. Solenoid Type. Operates on 1.5 volt dry cell. 3 ohm coil. 0 to 9999. Price 7/6, plus 9d. post.
TANNOY POWER MICROPHONE INSET. For Tele. L.S. No. 1, 2 and 3. (Y.A.2815). Brand new in sealed tins. Price 2/6 each.
SPEAKERS. All brand new by well known makers. 5" at 11/6, 3½" (large magnet) at 12/6, 8" at 14/6 each, 6½" (15Ω) at 14/6 each, 6½" (enclosed magnet) at 15/6 each, 8" at 15/6 each, 10" at 17/6 each. All 2 to 5Ω speech coil except where otherwise stated. Please add 1/- per speaker for post.
GERMANIUM CRYSTAL DIODES (G.E.C. or B.T.H.). Wire-ended 1/6 each, 13/6 doz.
VALVES. VR65 at 2/6 each. EA50 at 2/6 each.
144 MC/S TRANSMITTER (LESS VALVES). A compact TX Unit (10¼in. x 6in. x 4¼in.). Covering 2 metres band. Valve line up: 2-6C4's as Push-Pull V.F.O., 829 amp. and 832 (or 829) final amp. Variable inductance tuning all stages. V.F.O. coils missing. Can be used as TX, or driver for larger TX. A snip at 21/- each.

PLEASE WRITE NAME AND ADDRESS IN BLOCK LETTERS

C. MARKS & CO.,
90 COMMERCIAL ST., NEWPORT, MON.
Telephone : Newport 4711
Also at 25 Wyndham Arcade, Cardiff
All mail orders and enquiries to Newport branch please.

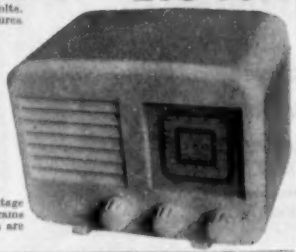
You're SURE to get it at

STERN'S

ESTABLISHED 25 YEARS

FOR HOME CONSTRUCTORS

A 5 VALVE 3 WAVEBAND SUPERHET RECEIVER for £10'10'-



For use on A.C. Mains 200 to 250 volts. The following are outstanding features:

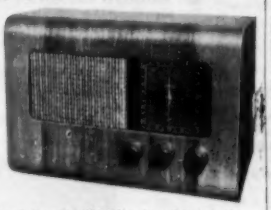
- A superhet circuit designed for high efficiency on all three wavebands.
- A 5½in. P.M. speaker accurately matched for good quality reproduction.
- The latest range of new 6-volt B.V.A. miniature valves.
- Built-in frame aerial with provision for external aerial for distant stations.
- A white plastic cabinet of very attractive appearance, overall size 7¾in. × 5½in. × 5¾in.

Send 2/6 for the fully descriptive stage by stage assembly and wiring diagrams with which complete price details are given.

!!!CONSTRUCTORS!!!

A NEW SUPERHET TRANSPORTABLE

THE "SUPER THREE"



Designed for local station reception without the use of an external aerial. This design provides for a 3 valve (plus Metal Rectifier) Superhet Receiver incorporating a Frame Aerial for "room to room" use, provision is also made for a short external aerial, if required, for the reception of Continental Stations.

Briefly the features are as follows:—

- For use on A.C. Mains 200-250 Volts.
- This set includes a Mains Transformer and Chassis is NOT live to mains (as many other sets of this type are) and consequently the Receiver can safely be used in the Kitchen, etc.
- Valve line up 6K8—6Q7—KT61, plus Metal Rectifier.
- The I.F. Transformer is supplied "pre-aligned" and thereby ensures extreme simplicity of Tuning—in fact, more simple than most T.R.F. Receivers.
- Compact and easy to build, simple "point to point" practical diagrams are supplied with a completely drilled chassis.

The complete Receiver Chassis can be built to cover the Medium Waveband only for **£6 . 6 . 6**

Or to cover both Long and Medium Waves for **£6 . 16 . 3**

If the Receiver is first built to cover the Medium Waveband, Long Waves can be added at any time, separate diagrams are provided for this purpose.

The attractive Polished Wood Cabinet 11½ inches wide, 8½ inches high and 6 inches deep Illustrated above is **£1 . 1 . 0**

The CONSTRUCTOR'S MANUAL is available for 1/-, this shows the component prices, which are all available for separate purchase.

AN AMAZING OFFER!

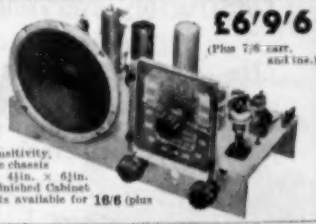
A COMPLETELY ASSEMBLED

4 VALVE T.R.F. CHASSIS

Including a 5in. P.M. SPEAKER and VALVES **FOR ONLY**

£6'9'6

(Plus 7/6 carr. and ins.)



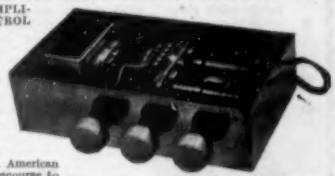
This receiver is of the very latest design and is for use on A.C. or D.C. Mains. It covers both Long and Medium Wavebands, and includes the modern BVA miniature valves. The line up being 12 BA6—12AT6—12A6—35W4. It incorporates Permeability Tuned Coils, thus ensuring excellent selectivity and sensitivity. The overall size of the complete chassis including speaker is 10½in. × 4½in. × 6½in. An attractive Bakelite Ivory finished Cabinet size 11½in. × 5½in. × 6½in. is available for **16/6** (plus 2/6 carriage and insurance).

"PERSONAL SET" BATTERY ELIMINATOR

A complete Kit of parts to build a Midget "Alldry" Battery Eliminator, giving approx. 69 volts and 1.4 volts. This eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet Receiver requiring H.T. and L.T. voltage as above, or approx. to 69 volts. The Kit is quite easily and quickly assembled and is housed in a light aluminium case size 4½in. × 1½in. × 3½in. Price of complete Kit with easy-to-follow assembly instructions, **42/6**.

In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts and 1.4 volts. Size of assembled unit 7in. × 2½in. × 1½in. Price **47/6**.

DUAL-CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT



This comprehensive PRE-AMPLIFIER and TONE CONTROL UNIT provides a full control of bass and treble in conjunction with a main Volume/Mixer Control.

It can be used with any amplifier and with any pick-up, the range of frequency control provided by the unit affording ample compensation for all types of pick-up and all natures of recordings, i.e., English, American and long-playing, without recourse to pick-up correction. The extreme flexibility of the bass and treble control is such that the level of bass and treble can be set to suit any conditions irrespective of the volume output of the amplifier. Response characteristics are given in 12-watt amplifier advt. The unit measures only 7in. × 4in. × 8in., including self-contained power supply and can be accommodated either on or away from the main amplifier, i.e., on the front panel of a cabinet or any other position. Prices including drilled chassis, valves (6SN7 and 6J5), **£3/16/9**. Complete assembly data are available separately for 1/-. Completely assembled and ready for use, **£5/5/-**.

The DENCO M.T.O.I. Modulated Test Oscillator £3/15/-

(Plus 2/- carr. and ins.) Has Frequency range continuously variable from 170-475 Kc/s. and 550-1,600 Kc/s. Battery operated and thereby completely self contained.

CONSTRUCTORS say "IT'S STILL THE BEST MAINS or BATTERY PORTABLE SET"

A Midget 4-valve Superhet Portable covering medium and long wavebands. Designed to operate on A.C. mains 200/240 volts or by an "Alldry" battery. The set is designed so that the main section can be supplied as a separate unit, and can be added at any time. The Set supplied as an "Alldry" battery Superhet can be accommodated in the attache case illustrated (size 9½in. × 4½in. × 7in.). This is attractively finished in lizard, maroon, dark green or blue rexine. As a combined Mains/Battery Superhet Portable a polished cabinet is available to accommodate both Mains Unit and Batteries. Circuit incorporates delayed A.V.C. and pre-selective Audio Feedback. The Set is complete in every detail and includes ready-wound frame aerials, fully aligned I.F. transf., and drilled chassis etc. Overall size of assembled chassis 8in. × 4in. × 2¾in. This receiver, as illustrated can be completely built for £8/16/3 (plus Mains Unit if required). Send 1/3 for the fully descriptive Assembly Book which includes Practical Layouts and complete Price list of Components. Attache case available separately, **37/6**.

BATTERY PORTABLE

THE "MINI TWO-THREE"

An "Alldry" Battery Portable of midget size, 6¾in. × 4¾in. × 3¾in. designed to cover medium waveband 190-550 metres, with use of short trailer aerial.

The simple design of this Receiver is so arranged that either a 3-valve set or a 2-valve (afterwards easily converted to the 3-valve) can be made.

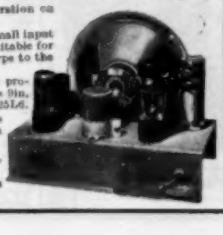
Consists of a T.R.F. circuit using a regenerative detector with H.F. stage and a high gain output pentode. Valve line up 1T4—1T4—DL94.

The 2-valve set can be completely built for **£4/3/6** (less case), and the 3-valve for **£5/3/-** (less case). Each price includes valves, speaker and drilled chassis.

Send 2/- for the assembly instructions; they include simple and complete practical component layouts and diagrams which enable the most inexperienced constructor to successfully build either set. All components are available for separate sale, a price list being supplied with assembly instructions.

A COMPLETE KIT OF PARTS TO BUILD A 3-4 WATT HIGH GAIN AMPLIFIER

For operation on A.C. or D.C. Mains, 200-250 volts.



This amplifier will give 3 watts output for the small input voltage of only 75 millivolts, and is therefore suitable for use with any type of pick-up from the crystal type to the miniature H/F Magnetic type.

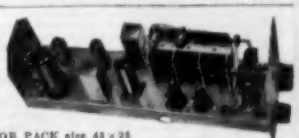
A tone control is incorporated and the quality produced is excellent. The overall size of chassis is 9in. × 5in. × 7in. and valve line-up 25Y5-6H7-25L6.

Price of complete kit, including drilled chassis and valves, **£4/2/9**, plus 6/in. P.M. (which fits on chassis **16/-**, or 8in. P.M., **18/9**.

Price of fully assembled chassis ready for use, **£5/5/-** (plus cost of speaker).

Copy of assembly instructions and components price list available for **1/3**.

A COMPLETE "CAR RADIO" FOR THE HOME CONSTRUCTOR



11¼in. × 4¼in. × 2¼in.

A design of a complete 5-VALVE SUPERHET RECEIVER employing an R.F. Stage and incorporating a separate VIBRATOR PACK size 4½ × 2½ × 5¼in. for use on 6 or 12 volt D.C. supplies.

We can supply all components to build this complete Receiver and Vibrator Pack including a Metal Case. Valves, Drilled Chassis and 5in. P.M. Speaker for **£12/10/6**. (Carr. and Ins. 5/6 extra.) Or the receiver Components for **£9/10/6** and the Vibrator Components for **£3**.

This is NOT an EX-GOVT. Receiver, it is a new design employing new Components. Send **2/6** for the complete set of ASSEMBLY INSTRUCTIONS, CIRCUITS and PRACTICAL LAYOUTS, including a complete individual Component Price List.

THIS IS A STERN'S ADVERTISEMENT

Constructors everywhere are amazed!

AT THE EXCELLENCE OF

The **"TELE-VIEWER"**

5 CHANNEL TELEVISOR

DESIGN OF A COMPLETE 12" SUPERHET T.V. RECEIVER

PERFECT PICTURE QUALITY – SIMPLE DIAGRAMS MAKE CONSTRUCTION EASY

PERFECT FRINGE AREA RECEPTION – BETTER RECEPTION AT HALF COMMERCIAL COST

Here are some of the features which combine to make this such a fine receiver.

- The Superhet circuit *easily* tuned to any of the five channels, i.e., LONDON, SUTTON COLDFIELD, HOLME MOSS, WENVOE and KIRK-O-SHOTTS. (The extreme ease of tuning is accomplished by the provision of pre-aligned I.F.T.s.)
- A lifelike, almost stereoscopic, picture quality made possible by the following factors :
  a. Excellent band width of I.F. circuits.
  b. A really efficient video amplifier.
  c. C.R.T. Grid modulated from low impedance source.
  d. High E.H.T. voltage (approx. 10 kV.).
  The picture brilliance is also much above the average and enables comfortable view with normal room lighting or daylight.
- FIRM picture "HOLD" circuits (Frame-Line) ensures a steady picture, free from bounce or flicker even under the most adverse conditions met with in "fringe" areas and excellent "interlace" ensures the absence of "liney effect."
- Negative feedback is used in the audio frequency circuits which provide 2/3 watts of High Quality Sound.
- Entire receiver built on two chassis units each measuring 14½" x 6½" x 3½".
- Rigid C.R.T. mounting enables entire receiver to be safely handled with tube in position.

This complete TELE-VISOR including all Valves, can be built for only (Plus cost of C.R.T.) **£28/16/4**

- All pre-set controls are mounted on side of chassis enabling all adjustments to be carried out whilst facing the C.R. Tube.

As no hire purchase terms are available the receiver can be bought in five separate stages (practical diagrams and circuits are provided for each stage) thus enabling hire purchase interest rates to be avoided. The complete set of ASSEMBLY INSTRUCTIONS is available, price 5/-. The instructions include really detailed PRACTICAL LAYOUTS, WIRING DATA AND COMPONENT PRICE LIST. ALL COMPONENTS ARE AVAILABLE FOR INDIVIDUAL PURCHASE.

NOW available at *Stern's*

The "WIDE ANGLE" TELE-VIEWER

- A design that retains all the distinctive features of the 12in. Televisor but with increased Time Base efficiency, producing 15 to 16 kV. E.H.T., with ample scanning power for C.R. Tubes up to 17in.
- It can be completely built including supply of all valves for **£33** (plus cost of C.R.T.) and is as simple to construct as the 12in. model.
- This is the most efficient "WIDE ANGLE" large screen design yet offered to constructors, and yet it can be built for almost half the cost of similar designs.
- Complete assembly instructions, diagram, etc., available for 5/-.

!! AMPLIFIERS !!

EASY TO BUILD KIT OF PARTS

A 4-VALVE QUALITY "PUSH-PULL" 6-8 watt AMPLIFIER for A.C. mains. Incorporating Negative Feedback. Filter Input Circuit and employing 6V6s in Push-Pull. A simple arrangement is provided to enable either a magnetic, crystal or lightweight pick-up to be used, and is suitable for use with Standard or long-playing records. A tone control is incorporated, and the 10-watt output transformer is designed to match 2 to 15 ohm speakers. The overall size of the assembled chassis is 10in. × 8in. × 7½in. high, and full practical diagrams are supplied. Price, including drilled chassis and valves, of complete kit, **£9/17/6**. Price of assembled chassis, supplied ready for use, **£8/12/6**. Plus 5/- Carr. & Ins. Full descriptive leaflets are available separately for 1/-.

A 12-watt HIGH FIDELITY "PUSH-PULL" AMPLIFIER designed for A.C. mains 200 to 250 volts employs 5 valves plus rectifier with negative feedback, and comprises a main amplifier chassis and a remote controlled Pre-amplifier and Tone Control Unit, incorporating four controls—bass, treble, main volume or mixing control, and a radio, gram, microphone, selector switch. This control unit measures only 7 × 4 × 2in. The measured frequency range of the amplifier with this unit shown an excellent response from 14,000 cycles down to 20 cycles, the bass and treble controls allowing independent control of gain at both ends of the frequency range from zero to a gain of 20. It can be seen, therefore that ample correction is provided to suit any type of pick-up with any type of recording. Input voltage for maximum output is 70 mV. 6.3 volts at 2 amps. and 20 mA. H.T. is provided for tuning unit, etc. Price of complete kit, including drilled chassis and valves, **£14**. Complete specification and layout, 2/-. We can also supply completely assembled and ready for use at **£17**. H.P. Terms (Assembled Chassis Only), **£5 18 3** Deposit and 12 months of **£1/1/4**. Plus 7/6 Carr. and Ins. **THIS AMPLIFIER COMPARES WELL WITH THE WILLIAMSON AND SIMILAR DESIGNS AT A FRACTION OF THEIR COST.**

SPECIAL OFFER

NEW C.R.T.s.

Unused 12in. C.R.T.s by one of the leading manufacturers. 6.3 volt heater, 7-9 kV. standard size. Supplied in maker's sealed cartons. **£12/19/6**
(Plus 15/- Carr. & Ins.)

BRAND NEW C.R.T. MASKS

Latest aspect ratio for 12in. "Round" tubes, finished Ivory. **12/6**
(Plus 1/- postage.)

HALF WAVE MAINS TRANSFORMERS

Primary 200/220, 220/240 volts.
Secondary 250 volts 50 mA.
6.3 volts 1½ amps. **16/9**
(Plus 1/- postage.)

SPEAKER BARGAINS

PLESSEY, 10in. 3 ohm V/coil	£1 5 0
TRUVOX, 12in. 3 ohm V/coil	£2 9 6
ROLA, 12in. 3 ohm V/coil	£3 19 6
BAKERS, 12in. 15 ohm V/coil	£4 15 6
GOODMANS, 12in. 15 ohm V/coil	£5 5 0

(Carriage & Ins. 1/6 extra.)

THE NEW W. B. "STENTORIAN"

HI FI SPEAKERS ARE IN STOCK

Model H.F. 6-inch	£2 10 6
Model H.F. 9-inch	£3 7 0
Model H.F. 8-inch	£3 0 6
Model H.F. 10-inch	£3 13 6

These speakers are of the very latest design and provide quality reproduction for the lower-price range. 3 or 15 ohm models are available.

VARLEY HEATER TRANSFORMER

Input 200-250 volts. Output 4 volts (tapped at 2 volts) 5 amps. **14/9** (1/- post.)

FILAMENT TRANSFORMER

6.3 v. 1½ a.	5/3
4 v. 1½ a.	5/9

RECEIVER CHASSIS

Modernise your old Radiogram

RECORD PLAYERS

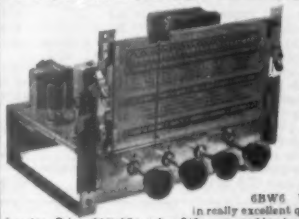
COMPLETE RADIOGRAM EQUIPMENT—QUALITY AT LOW COST

THREE COMPLETELY ASSEMBLED ALL-WAVE SUPERHET CHASSIS

- Model B.3 A 5-valve 3-waveband Receiver.
- Model B.3.P.P. A 6-valve 3-waveband Receiver with PUSH-PULL OUTPUT.
- Model B.3.P.P./R.F. A 7-valve 3-waveband Receiver incorporating an R.F. stage with PUSH-PULL OUTPUT.

The three Receivers are for operation on A.C. mains 100/110 volts and 200/250 volts, and employ the very latest miniature valves. They are designed to the most modern specification, great attention having been given to the quality of reproduction which gives excellent clarity of speech and music on both gram. and radio, making them the ideal replacement chassis for that "old Radiogram," etc.

Brief specifications: **Model B.3.**—Valve line-up, 6BE6, 6BA6, 6AT6, 6BW6, 6X4—waveband coverage short 16-50, medium 187-550, long 900-2,000 metres. Controls: (1) volume with on/off; (2) tuning (flywheel type); (3) wavechange and gram.; (4) tone (3-position switch operative on gram. and radio). Negative feedback is employed over the entire audio stages. Chassis size: 11 × 7½ × 8½in. high. Dial size 8½ × 4½in. Price complete and READY FOR USE, excluding speaker, £12/12/- (carr. and ins. 7/6 extra).

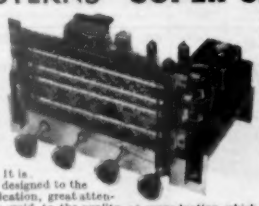


H.P. Terms: £4/4/- deposit, 12 months at 15/9.

Model B.3.P.P. This model is the B.3 Receiver but incorporates two 6BW6 VALVES in PUSH-PULL, resulting in really excellent quality reproduction up to approximately 6 watts. Price £15/15/- (plus 7/6 carr. and ins.) or £5/5/- deposit, 12 months at 10/6.

Model B.3. P.P./R.F. This model is similar in appearance and has same waveband coverage as the Model B.3, but in addition it incorporates an R.F. STAGE together with PUSH-PULL OUTPUT, employing a total of 7 valves with two type 6BW6 in Push-Pull. This makes for a really sensitive receiver with genuine quality reproduction. Price £18/18/- (plus 7/6 carr. and ins.) or £6/6/- deposit, 12 months at 23/7.

A NEW DESIGN FOR HOME CONSTRUCTORS
The STERNS "SUPER SIX"



A compact and highly efficient Superhet Radio-Radiogram Chassis of outstanding quality, far above any other design yet offered to the HOME CONSTRUCTOR. YOU can build it for

£10/7/6

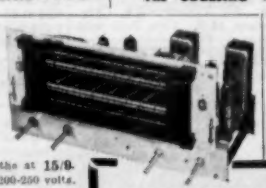
It is designed to the very latest specification, great attention having been paid to the quality of reproduction which gives excellent clarity of speech and music on both radio reception and record playing. A few brief details:—

- Covers 3 Wavebands 16-50 metres, 190-550, 800-2,000 metres.
- Employs 6 Valves having PUSH-PULL for 5-6 watts OUTPUT.
- DELAYED A.V.C. on all WAVEBANDS.
- PRE-SELECTIVE FEEDBACK.
- 5 POSITION TONE CONTROL.
- REAL QUALITY ON BOTH RADIO AND GRAM.
- PROVIDES INDEPENDENT MAINS SUPPLY FOR RECORD PLAYER (if required).
- FOR A.C. MAINS SUPPLY 200-250 Volts, 50 Cycles.
- Size of assembled CHASSIS 12in. long × 8in. × 8in. Dial Aperture 8½in. × 4½in.

THE ASSEMBLY MANUAL IS AVAILABLE FOR 2/-. This gives very detailed practical drawings and layouts and includes a component price list.

THE COMPLETE RECEIVER CAN BE BUILT FOR £10/7/6 with the OCTAL VALVE LINE UP or for £12/7/6 with Miniature Valves.

A Replacement RADIO-RADIOGRAM CHASSIS



- MODEL AWS-5. A 5-Valve Superhet Receiver covering the standard 3 wavebands, 16-50, 190-550, 800-2,000 metres PRICE COMPLETELY ASSEMBLED AND READY FOR USE (plus 7/6 carr. and ins.).

£10/10/-

H.P. Terms £3/10/- Deposit and 10 Months at 15/9. This receiver is for operation on A.C. Mains 200-250 volts. It contains the latest MULLARD VALVE LINE UP, being ECH42 (Freq. Ch.), EF41 (I.F.), EBC41 (Det. 1st Audio), EL41 (Output) and EZ41 (Rect.). It incorporates Negative Feedback and delayed A.V.C., the four controls being (1) Tuning, (2) Wavechange and Gram. Switch, (3) TONE, (4) VOLUME-OFF. It provides really good reproduction on both Gram. and Radio and gives an exceptionally good range of station selection. Overall size 13½in. × 7in. high × 6in. deep. Dial aperture 10in. × 4½in.

This AUTOCHANGE UNIT by a famous Manufacturer is offered for £10/10/0 (Plus 7/6 Carr. and Ins.)

Hire Purchase Terms £3/10/0 Dep. and 10 Months at 15/9.

(Normal price is £16/10/-.)

- These units will autochange on all three speeds, 7in., 10in and 12in.
- They play MIXED 7in. 10in. and 12in. records.
- They have separate sapphires for L.P. and 78 r.p.m., which are moved into position by a simple switch.
- Minimum baseboard size required 14in. × 12½in., with height above 5½in. and height below baseboard 2½in. A bulk purchase enables us to offer these BRAND NEW UNITS at this exceptional price.

The COLLARO 3RC/521 3-SPEED AUTO CHANGE UNIT

£9/19/6 (Plus 7/6 Carr. and Ins.)

H.P. Terms £3/6/0 Deposit and 10 months at 15/-.

Normal price £18/10/-.

- Complete with High Fidelity Crystal "Turnover" Head which incorporates separate stylus for L.P. and 78 r.p.m. Records.
- Will autochange on 7in., 10in. and 12in. records not intermixed.
- Minimum Base plate size 15in. × 12½in., with height above 4½in. and below baseplate 3in.
- Brand new in Maker's Cartons, complete with Mounting instructions.

SPECIAL REDUCTIONS FOR COMPLETE EQUIPMENT

SUMMARY

Select a RECORD PLAYER and CHASSIS, and we will supply it TOGETHER WITH AN 8inch or 10inch P.M. SPEAKER as follows:

THE £10/10/- AUTOCHANGER WITH A SPEAKER AND :—

	CASH PRICE	DEPOSIT	MONTHLY
(a) With Model B.3 Chassis	£23/15/-	£7/18/4	12 of £1/9/6
(b) " " B3PP	£27	£9	12 of £1/12/0
(c) " " B3PP/RF "	£30/2/-	£10/2/-	12 of £1/17/6
(d) " " Super Six " (Assembled chassis only)	£27	£9	12 of £1/12/0
(e) " " AW3-5 "	£21/15/-	£7/5/-	12 of £1/7/3

THE COLLARO AUTOCHANGER MODEL 3RC/521 WITH A SPEAKER AND :—

(a) with Model B3 chassis	£23/6/-	£7/15/6	12 of £1/9/3
(b) " " B3PP	£26/9/-	£8/16/6	12 of £1/13/1
(c) " " B3PP/RF "	£29/12/-	£9/17/-	12 of £1/17/0
(d) " " Super Six " (Assembled chassis only.)	£26/9/-	£8/16/6	12 of £1/13/1
(e) " " AW3-5 "	£21/4/-	£7/1/4	12 of £1/6/6

THE COLLARO 3-SPEED UNIT MODEL 3/514 WITH A SPEAKER AND :—

(a) With Model B3 chassis	£21/6/-	£7/3/4	12 of £1/6/6
(b) " " B3PP	£24/9/-	£8/5/8	12 of £1/10/1
(c) " " B3PP/RF "	£27/12/-	£9/4/-	12 of £1/14/8
(d) " " Super Six " (Assembled chassis only.)	£24/9/-	£8/3/6	12 of £1/10/1
(e) " " AW3-5 "	£19/4/-	£6/8/-	12 of £1/4/0

An Additional Charge of 10/- is made in each case to cover Carriage and Insurance.

The COLLARO MODEL 3/514 3-Speed Non-Auto Change Unit

£7/19/6 (Plus 6/- Carr. and Insur. Normal Price £12/17/6

- Complete with High Fidelity Crystal "TURNOVER" Head which incorporates a separate stylus for L.P. and Standard Records.
- Will play 7 inch, 10 inch and 12 inch Records.
- Brand New and Complete with mounting instructions.

When submitting orders please include post and packing

STERN RADIO Ltd.
109 & 115, FLEET STREET, E.C.4

Tel.: CENTRAL 5812-3-4

SELENIUM RECTIFIERS

L.T. Types		H.T. Types H.W.	
2/6 v. ½ a.h.w....	1/9	70 v. 20 mA. ...	2/11
6/12 v. ½ a.h.w.	1/9	90 v. 20 mA. ...	3/6
		120 v. 40 mA. ...	3/11
		250 v. 50 mA. ...	5/9
F.W. Bridge Types		250 v. 80 mA....	7/9
6/12 v. 1 a.	5/9	RM2 125 v. 100 mA.....	3/11
6/12 v. 2 a.	9/9	RM3 125 v. 120 mA.....	4/11
6/12 v. 4 a.	14/9	RM4 250 v. 250 mA.....	11/9
6/12 v. 6 a.	19/9	300 v. 275 mA.	12/11
6/12 v. 10 a. ...	29/9		

CO-AXIAL CABLE. 75 ohms ¼in., **7d.** yard.

RHEOSTATS (VARIABLE RESISTORS) 2 ohms 5 amps, **6/9**; 7.5 ohms 5 amps, **6/9**; 0.4 ohm 25 a., **6/9**; 150 ohms 1.5 amps, **14/9**. All complete with control knob.

SILVER MICA CONDENSERS. 5, 10, 15, 20, 25, 30, 35, 50, 100, 120, 150, 180, 200, 230, 300, 330, 400, 470, 500, 1,000 pfd. (.001μF), .002 mfd. (2,000 pfd.). All at **5d.** each, **3/9** dozen one type.

DIAL BULBS, M.E.S., 8 v. 0.15 a., **6/9** doz.; 6.5 v. 0.15 a., **6/9** doz.

ELECTROLYTICS (Current production.) NOT ex-Govt.

Tubular Types		Can Types	
8μF 450 v. ...	1/11	16μF 450 v. ...	2/9
16μF 350 v. ...	2/3	24μF 350 v. ...	2/11
16μF 450 v. ...	2/9	32μF 350 v. ...	2/11
16μF 500 v. ...	3/9	32 mfd. 450 v.	4/6
24μF 350 v. ...	3/3	64 mfd. 450 v.	4/3
32μF 350 v. ...	3/9	8-8μF 350 v. ...	3/3
32 mfd. 500 v.	5/9	8-8μF 450 v. ...	3/11
8-16μF 500 v.	4/11	8-8 mfd. 500 v.	4/9
25μF 25 v. ...	1/3	8-16μF 450 v.	2/11
50μF 12 v. ...	1/3	16-16μF 450 v.	4/11
50μF 50 v. ...	2/3	16-32μF 350 v.	4/9
Can Types		16-32 mfd. 450 v.	4/9
8mfd. 450 v.	2/3	32-32μF 350 v.	4/9
8mfd. 500 v.	2/9	32-32μF 450 v.	5/11
16mfd. 350 v.	1/11	60-100 mfd. 450 v.	7/9

AMPLIFIER OR CHARGER CASES. Size 14½ × 5½ × 7½ins. high. Strongly made in perforated steel. Grey enamel finish. Only **9/6**.

R.S.C. TRANSFORMERS

FULLY GUARANTEED, INTERLEAVED AND IMPREGNATED

MAINS TRANSFORMERS
Primaries 200-230-250 v. 50 c/s.

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250 v. 60 mA., 6.3 v. 2 a., 5 v. 2 a., Midget type 2½-3in.	18/6
350-0-350 v. 70 mA., 6.3 v. 2 a., 5 v. 2 a. ...	18/9
300-0-300 v. 60 mA., 12 v. 1.5 a., c.t.	18/11
250-0-250 v. 100 mA., 6.3 v.-4 v. 4 a. c.t., 0-4-5 v. 3 a.	25/9
250-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a. for R1355 conversion	31/6
300-0-300 v. 100 mA., 6.3 v.-4 v. 4 a. c.t., 0-4-5 v. 3 a.	33/9
350-0-350 v. 100 mA., 6.3 v.-4 v. 4 a. c.t., 0-4-5 v. 3 a.	25/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	31/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	33/9
350-0-350 v. 250 mA., 6.3 v. 6 a., 4 v. 8 a., 0-2-6 v. 2 a., 4 v. 3 a., for Electronic Eng. Televisor	69/6
425-0-425 v. 200 mA., 6.3 v. 4 a., c.t., 6.3 v. 4 a., c.t., 5 v. 3 a., suitable Williamson Amplifier, etc.	49/9
425-0-425 v. 250 mA., 6.3 v. 6 a., 6.3 v. 6 a., 5 v. 3 a.	69/6

TOP SHROUDED DROP THROUGH TYPE

250-0-250 v. 70 mA., 6.3 v. 2.5 a.	12/11
260-0-260 v. 70 mA., 6.3 v. 3 a., 5 v. 2 a. ...	14/11
350-0-350 v. 80 mA., 6.3 v. 2 a., 5 v. 2 a. ...	17/6
350-0-350 v. 80 mA., 6.3 v. 3 a., 4 v. 2.5 a. ...	14/11
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a. ...	23/9
300-0-300 v. 100 mA., 6.3 v.-4 v. 4 a., c.t., 0-4-5 v. 3 a.	23/9
350-0-350 v. 100 mA., 6.3 v. 4 a., c.t., 5 v. 3 a.	23/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	29/11
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	27/9

E.H.T. TRANSFORMERS. 2,500 v. 5 mA., 2-0-2 v. 1.1 a., 2-0-2 v. 1.1 a., for VCR97, VCR517 or ACR2X **36/6**
5,000 v. 5 mA., 2 v. 2 a. **39/6**

FILAMENT TRANSFORMERS
Primaries 200-250 v. 50 c/s.

6.3 v. 1.5 a. ...	5/9	6.3 v. 2 a. ...	7/6
6.3 v. 3 a. ...	9/6	0-4-6.3 v. 2 a. ...	7/9
12 v. 1 a.	7/11	6.3 v. 6 a.	17/6
0-2-4-5-6.3 v. 4 a.	16/9	12 v. 3 a. or 24 v. 1.5 a.	17/6

CHARGER TRANSFORMERS
All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1.5 a., **12/9**; 0-9-15 v. 3 a., **16/9**; 0-9-15 v. 6 a., **22/9**; 0-9-15-30 v. 3 a., **23/9**.

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s. 120 v. 40 mA.	7/11
120 v. 40 mA. 5-0-5 v. 1 a.	14/9

OUTPUT TRANSFORMERS

Midget Battery Pentode 66: 1 for 3S4, etc.	3/6
Small Pentode, 5,000Ω to 3Ω	3/9
Standard Pentode 5,000Ω to 3Ω	4/9
Standard Pentode, 8,000Ω to 3Ω	4/9
Standard Pentode, 10,000 ohms to 3 ohms	4/9
Multi-ratio 40 mA. 30:1, 45:1, 60:1, 90:1, Class B Push-Pull	5/6
Push-Pull 8 Watts 6V6 to 3 ohms	8/9
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω...	15/9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push-Pull 15 Watt 6L6s, KT66s, etc. to 3 or 15 ohms	19/9
Push-Pull 20 Watts high-quality sectionally wound 6L6, KT66, etc., to 3 or 15Ω	47/9

SMOOTHING CHOKES

250 mA., 3 H. 50 ohms	11/9
100 mA., 10 H. 200 ohms, Potted	8/9
80 mA., 10 H. 350 ohms	5/6
60 mA., 10 H. 400 ohms	4/11
50 mA., 40 H. 1,000 ohms Potted	10/9
20 mA., 30 H. 1,000 ohms	4/9

MICROPHONE TRANSFORMERS
100:1 ..... **5/9**

VOLUME CONTROLS with long spindles, all values less switch, **2/6**; with S.P. switch, **3/9**.

WIRE WOUND POTS: 30 ohms, 500 ohms, 1,000 ohms, 5K, 20K, 50K (medium length spindles), **2/9**. 220 ohms, 2K, 10K, 20K, 50K Preset type, **1/9** ea.

AMMETERS. Moving coil. G.E.C. 0—5 amps, 2in. scale, **11/9**.

EX-GOVT. E.H.T. SMOOTHING CONDENSERS

.02 mfd. 8,000 v. Cans	1/11
.25 mfd. 4,000 v. Blocks	4/9
.5 mfd. 2,500 v. Blocks	3/9
.5 mfd. 3,500 v. Cans	3/3
.1 mfd. plus .1 mfd. 8,000 v., large blocks (common negative isolated)	9/6
1.5 mfd. 4,000 v. blocks	5/9

EX-GOVT. ACCUMULATORS with non-spill vents. Unused and guaranteed. 2 v. 16 A.H., **5/9** each, or 3 in wood carrying case 9—7—5in., **14/9**, plus 2/6 Carr.

EX-GOVT. BLOCK PAPER CONDENSERS

4 mfd 500 v. ...	2/9	4 mfd. 2000 v.	6/9
4 mfd. 1500v.	4/9	11-7 mfd. 500v.	8/9
4 mfd. 400 v. plus 2 mfd. 250 v.,	1/11.		

EX-GOVT. TRANSMITTER-RECEIVER TYPE TR9D, complete with all valves, only **47/9**, plus carr. 5/-.

EX-GOVT. AUTO TRANSFORMERS 50 c/s.

Double Wound 10-0-200-220-240 v. to 10-0-270-290-310 v. 200 watts	25/9
Double Wound 100 watts, 5-0-115-125 v. to 10-0-10-210-230 v. or reverse	18/9
15-10-5-0-195-215-235 v. 200 watts	25/9
0-110-190-230 v. 400 watts	40/6
Double Wound 220/240 v. input. Output 55 v. to 230 v. 21 amps in steps of 11 v. ...	29/6
Double Wound 10-0-200-220-240 v. to 10-0-275-295-315 v. 500 watts	69/6

M.E. SPEAKERS. All 2-3 ohms, 6½in. Rolafield 700 ohms, **11/9**. 10in. R.A. field 600 ohms, **23/6**. 10in. R.A. field 1,500 ohms, **23/6**. 10in. R.A. field 1,000 ohms, **23/9**.

THE SKY CHIEF T.R.F. RECEIVER

A design of a 4-stage, 3 valve 200-250 v. A.C. Mains receiver with selenium rectifier. For inclusion in any of cabinets illustrated above. It consists of a variable Mu high gain H.F. stage followed by a low distortion grid detector triode. The next stage is a further triode amplifier with tone correction by negative feedback. Finally comes the output stage consisting of a parallel connected double triode giving ample output at an extraordinary low level of distortion. Point to point wiring diagrams, instructions, and parts list, **2/6**. This receiver can be built for a maximum of **£4/16/-** including cabinet.

P.M. SPEAKERS. All 2-3 ohms. 2½in. Celestion, **14/9**. 3½in. Goodmans (Ex New Units), **10/9**. 4in. Goodmans, **14/11**. 5in. Goodmans, **15/6**. 6½in. Goodmans, **16/9**. 8in. Plessey, **15/9**, 10in. Rola, **27/9**. 10in. Plessey, **18/6**. 10in. Rola with Trans., **29/6**. 12in. Truvox, **49/9**.

R.S.C. BATTERY CHARGER KITS. For mains input 200-250 v. 50 c/s. To charge 6 v. accumulator at 2 amps., **25/9**. To charge 6 v. or 12 v. battery at 2 a., **31/6**. To charge 6 v. or 12 v. battery at 4 a., **49/9**. ABOVE KITS CONSIST OF BLACK CRACKLE LOUVRED STEEL CASE, MAINS TRANSFORMER, FULL WAVE METAL RECTIFIER, FUSES, FUSE-HOLDERS AND CIRCUIT. Any type assembled and tested for **6/9** extra.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT with case, Mains input 200-250 v. Output 120 v. 40 mA. and 2 v. ½ a. Price with circuit **29/6**. Or in working order, **37/6**.

EX. GOVT. MAINS TRANSFORMERS
All 230 v. 50 c/s input.

250-0-250 v. 40 mA., 6.3 v. 2 a., 5 v. 2 a.	9/11
8.8 v. 4 a.	9/9
48 v. 1 a.	9/6
175 v. 200 mA.	9/9
0-11-22 v. 15 a.	35/9
0-11-22 v. 30 a.	72/6
16/20 v. 35 a.	79/6
7.7 v. C.T. 7 amps 4 times	25/9
460 v. 200 mA., 6.3 v. 5 a.	27/9
300-0-300 v. 150 mA., 610-0-610 v. 150 mA., 1,220 v. 350 mA.	29/9

EX-GOVT. SMOOTHING CHOKES

250 mA., 10 H. 50 ohms	14/9
250 mA. 10 H. 100 ohms	14/9
250 mA. 3 H. 50 ohms. Potted	8/9
150 mA. 10 H. 50 ohms	10/11
100 mA. 10 H. 100 ohms. Tropicalised	6/9
100 mA. 5 H. 100 ohms. Tropicalised	3/11
90/100 mA. 10 H. 100 ohms. Potted	8/9
50 mA. 5-10 H.	2/9
L.T. type 1 amp.	2/9

EX-GOVT. T.V. TYPE TRANSFORMERS. All 230 v. 50 c/s input.

1100-0-1100 v. 250 mA.	25/-
2800 v. 30 mA.	22/9
400 v. C.T. 150 mA. 4 v. 6 a., 6.3 v. 6 a., 6.3 v. 0-6 a., 4 v. 6 a., 4 v. 3 a., 4 v. 3 a., 4 v. 3 a., 5 v. 2 a.	22/9

CHASSIS

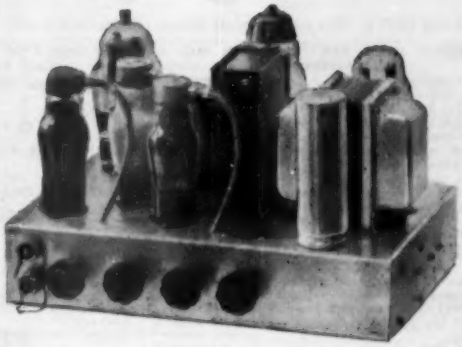
18 s.w.g. undrilled aluminimum amplifier type (4-sided).	16 s.w.g. aluminium, receiver type.
12in. × 9in. × 2½in. ...6/11	12in. × 8in. × 2½in. ...5/3
14in. × 9in. × 2½in. ...6/11	16in. × 8in. × 2½in. ...7/6
14in. × 10in. × 3in. ...7/11	20in. × 8in. × 2½in. ...8/11
16in. × 10in. × 3in. ...8/3	
18 s.w.g. aluminium receiver type.	16 s.w.g. aluminium, amplifier type, 4-sided.
6in. × 3½in. × 1½in....1/11	12in. × 8in. × 2½in. ...7/11
7½in. × 4½in. × 2in.... 2/9	16in. × 8in. × 2½in. 10/11
10in. × 5½in. × 2in. ... 3/3	20in. × 8in. × 2½in. 13/6
11in. × 6in. × 2½in. ...3/11	14in. × 10in. × 3in. 13/6

R.S.C. 25 WATT "PUSH-PULL" AMPLIFIER

Now firmly established and proving extremely popular, our A11 Quality Amplifier we consider to be the best value in amplifiers offered to-day. The volume of its high fidelity reproduction is completely controllable, from the sound of a quiet intimate conversation to the full glorious volume of a great orchestra. Its sensitivity is so high that in areas of fair signal strength it can be operated straight from a crystal receiver. Entirely suitable for standard or long-playing records in small homes or in large auditoriums. For electronic organ or guitar or for garden parties or dance bands.

The kit is complete to the last detail, and includes easy to follow point-to-point wiring diagrams.

Twin volume controls with twin input sockets allow SIMULTANEOUS INPUTS for BOTH MICROPHONE and GRAM, or TAPE and RADIO. SEPARATE BASS and TREBLE CONTROLS giving both LIFT and CUT. FOUR NEGATIVE FEEDBACK LOOPS with 15 db in the main loop from output transformer to voltage amplifier. Frequency response ± 3 db 50-20,000 c.p.s. Hum and distortion LESS THAN 0.5 per cent. measured at 10 watts. This is comparable with some of the highest priced amplifiers. Six B.V.A. valves, Marconi-Osram KT series output valves. A.C. only, 200-230-250 v. 50 c/s. input. 420 v. H.T. LINE. Paper reservoir condenser. Compact chassis. Matched components. OVERALL SIZE 12 × 10 × 9in. approx. Output impedances for 3 and 15 ohms speakers.



Available in kit form at the amazingly low price of **9 gns.** Plus carriage 5/-

Or ready for use 50/- extra.

W.B. "STENTORIAN" High fidelity P.M. Speaker, HF1012, 10 watts. 15 ohm (or 3 ohm) speech coil. Where a really good quality speaker at a low price is required we highly recommend this unit with an amazing performance. **£3/13/6.**

CONNOISSEUR HIGH FIDELITY LIGHTWEIGHT MAGNETIC PICK-UP, COMPLETE WITH MATCHING TRANSFORMER. A fortunate purchase enables us to offer limited supplies. Brand New, Boxed and Perfect at a fraction of normal price. Buy Now at only **28/6.**

COLLARO 3-SPEED AUTOMATIC RECORD CHANGERS (brand new), type 3RC/521, complete with 2 plug-in Crystal P.U. heads for long playing or standard records 7, 10 or 12 in. Not intermixed. Mains input 200-250 v. Limited number available at only **£9/19/6,** plus carr. 5/-.

COLLARO 3-SPEED MIXER AUTOCHANGER, Type 3RC/522 with 2 plug-in Crystal P.U. Heads with Sapphire Stylus for long playing or standard records. Plays 7, 10, and 12 in. records intermixed. Limited number, Brand New, Cartoned. **£10/19/6** (approx. half price). Carr. 5/- extra.

COLLARO TAPE DESK MOTORS. Shaded pole type. Clockwise or anti-clockwise. Mains input 110-200-250 v., **31/6.**

H.M.V. LONG PLAYING RECORD TURNTABLE COMPLETE WITH CRYSTAL PICK-UP (SAPPHIRE STYLUS). Speed 33⅓ r.p.m. BRAND NEW, CARTONED. Only **£3/19/6** (approx. half price). Carr. 5/-. (For 200-250 v. A.C. Mains).

A PUSH-PULL 3-4 WATT HIGH-GAIN AMPLIFIER FOR £3/12/6

plus carr. 2/6

For mains input 200-250 v. 50 c/s. Complete kit of parts including point-to-point wiring diagrams and instructions. Amplifier can be used with any type of feeder unit or pick-up. Output is for 2-3 ohm speaker. (We can supply a very suitable 10in. unit by Rola at **27/6.**) The amplifier can be supplied ready for use for **25/-** extra. Full descriptive leaflet **7d.**

R.S.C. MASTER INTERCOMM. UNIT, with provision for up to 4 "Listen—Talk Back Units" individually switched. A high gain amplifier enables speech and other sounds emanating from the rooms containing remote control units to be heard at the master control. The unit is in kit form and point-to-point wiring diagrams are supplied. A walnut veneered wood or Brown Bakelite cabinet is included. Mains input is 200-250 v. 50 c/s. H.T. line 300 v. CHASSIS IS NOT "ALIVE." Ideal also for use as "Baby Alarm." Sound amplification 4 watts. Price only **£5/19/6.** "Listen—Talk Back Unit" can be supplied at **30/-** each. Full descriptive leaflet 10d.

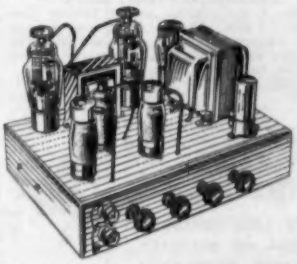
The Master Unit can be supplied assembled and tested for **30/-** extra.

PERSONAL SET BATTERY SUPERSEDER KIT.

All parts for an "All Dry" Battery Eliminator. Complete with case. Supplies 90 v. 10 mA. and 1.4 v. 250 mA. fully smoothed, from normal. 200-250 v. 50 c/s mains. For 4-valve superhet receivers. Price with circuit, **35/6.** Or ready for use, **42/6.** Size of unit 5¼-4-1¼in.

BATTERY SET CONVERTER KITS. All parts for converting any type of battery receiver to all mains. A.C. 200-250 v. 50 c/s. Kit will supply fully smoothed H.T. of 120 v. 90 v. or 60 v. at up to 40 mA., and fully smoothed L.T. of 2 v. at 0.4 a. to 1 a. Price complete with circuit and instructions only **48/9.** Supplied ready for use for 8/9 extra.

R.S.C. 10-watt "Push-Pull" HIGH-FIDELITY AMPLIFIER A3



Complete with integral pre-amp. Tone control stage (as A11 amplifier), using negative feedback, giving humproof individual bass and treble lift and cut tone control. **Six Negative Feedback Loops.** Completely negligible hum and distortion. Frequency response ± 3 db. 30-20,000 c.p.s. Two independently controlled inputs. Six B.V.A. valves. A.C. mains 200-230-250 v. input only. Outputs for 3 or 15 ohm speakers. Kit of parts complete in every detail, **£7/10/6,** plus 5/- carriage, or ready for use, **45/-** extra. Descriptive leaflet **1/-.**

FOUR STAGE RADIO FEEDER UNIT. Design of a HIGH FIDELITY, L. and M. wave T.R.F. Unit with self-contained heater supply and thorough H.T. decoupling. Only 250-400 v. 15-20 mA. H.T. required from main amplifier. Three valves and Low Distortion Germanium Diode Detector. Flat topped response characteristic. Loaded H.F. coils. Two variable Mu controlled H.F. stages, 3 gang condenser tuning. Cathode follower output stage. Switch position for Gram. and Gram. input and output sockets. Performance comparable with the best in Feeder Units. For A.C. mains 200-230-250 v. operation. Size 11-6-7½in. Illustration, full set of easy-to-follow wiring diagrams and instructions and individually priced parts list 2/6. This unit can be built for only **£3/15/-,** including Dial and Drive Knobs and every item required.

R.S.C. TONE CONTROL-PRE-AMP. UNIT. A complete set of parts for the construction of a very efficient but simple pre-amplifier and tone control unit. For use with any amplifier and pick-up. Fil. supply self-contained. Size 7½-5-5½in. approx. Descriptive leaflet **9d.** Price, inc. wiring diagrams, **37/6.** Ready for use, **15/-** extra.

Radio Supply Co. (LEEDS) LTD.

32 THE CALLS. — LEEDS, 2.

Terms C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/- extra under 10/-, 1/6 extra under £2, 1/11 extra under £3. Full Price List 6d. Trade List 5d.
Open to Callers: 9 a.m. to 5-30 p.m. Saturdays until 1 p.m.

Prices slashed at Clydesdale

PLEASE NOTE. Carriage and Postal charges refer to the U.K. only. Overseas freight, etc., extra.

SUPPLY UNIT RECTIFIER FOR NO. 43 TRANSMITTER

Ex-Canadian Army, in original wood case. Input 110 volts A.C. 50/60 c/s, 1.7 kVA. Output (HT1) 2,100 V. 375 mA. (HT2) 500 V. 400 mA., plus H.T. lines, 450 V. 265 V., also 383 V., regulated and neg. bias 250 V. 150 V., 80 V. Making 3 complete power supplies all fed via double choke condenser. Input circuits. Valves are 4/866A/866, 5Z3, 6517, 2/6A3, VR150/30 (Stab) and IV. (Time delay.) The complete unit mounted in metal case with lid shock mounted. Dim.: 2ft. 6in. x 1ft. 6in. x 1ft. Finish Olive Drab. Wgt. 420 lb.

ASK FOR X/H26 — **£25.0.0** each — CARRIAGE PAID

RECEIVER 6A

Channel checking Unit working on 49-100 metres, contains 5/VR91 (EF50), 1/6K8, 1/VR55 (EBC33), 1/VR53 (EF39) valves. Thermal switch breaking at 85 deg. F., etc., etc., in metal case 8½in. x 7in. x 10in.

ASK FOR X/H477A — **29/6** each — CARRIAGE 2/6 EXTRA

POWER UNIT TYPE 266

In Transit case. Input 80 v. 1.5 K/cps. A.C. Outputs HT 120 v. D.C., bias 3 and 9 v. LT 2 v. Smoothed and stabilized. Complete with 5U4G valve VS110 stabilizer. 12 v. 1 a. Metal rectifier, etc., etc., in attractive metal case with handles. Dim.: 11in. x 9½in. x 7½in.

ASK FOR X/E070 — **22/6** each — CARRIAGE PAID

SUPPRESSOR UNIT 5C/870

Contains 4 H.F. Chokes and 4 Tubular Condensers 0.1 mfd. 250 v. D.C. carrying 5 amps. (2 sets on each lead), each choke and condenser separately screened in compartments of aluminium alloy, box 4½in. x 4in. x 2in. 4-hole fixing.

ASK FOR X/H907 — **2/6** each — POST 1/- EXTRA

ELECTROLYTIC CONDENSERS, Metal Can, Clip Mtg. Types.

Cap. 24-24 mfd. 450 v. D.C. Wkg. Dia. 1⅛in. x 2in.
ASK FOR X/H971 — 3/- each — Or 3 for 7/6, post paid — POST 3d.

Cap. 16-24 mfd. 450 v. D.C. Wkg. Dia. 1⅛in. x 2½in.
ASK FOR X/H972 — 3/- each — Or 3 for 7/6, post paid — POST 3d.

Cap. 8-16 mfd. 450 v. D.C. Wkg. Dia. 1⅛in. x 2½in.
ASK FOR X/H918 — 3/- each — Or 3 for 7/6, post paid — POST 3d.

Cap. 32 mfd. 450 v. D.C. Wkg. Dia. 2in. x 4½in. With waxed cardboard cover and mtg. Plate. U.S.A. made.
ASK FOR X/H852 — 1/9 each — Or 3 for 5/-, post paid — POST 6d.

Cap. 8 mfd. 450 v. D.C. Wkg. Dia. 1in. x 2in.
ASK FOR X/H973 — 1/9 each — Or 3 for 5/-, post paid — POST 3d.

Cap. 8 mfd. 450 v. D.C. Wkg. Dia. ⅞in. x 2⅛in. Tubular, card covered, wire ends.
ASK FOR X/H980 — 1/6 each — Or 3 for 4/-, post paid — POST 3d.

Cap. 50 mfd. 12 v. D.C. Wkg. Dia. ⅞in. x 1⅛in., clip mtg. not necessarily.
ASK FOR X/H974 — 1/- each — Or 3 for 3/-, post paid — POST 3d.
Mtg. clips, for above, 4d. each.

5-WAY GROUPBOARD

Paxolin panel 2½in. x 2½in., with tags for mtg., 5 cond. or resistors, two-hole fixing.
ASK FOR X/H981 — 6d. each — Or 3 for 1/6, post paid — POST 3d.

24-WAY GROUPBOARD

Paxolin panel 12 3/16in. x 2½in. wide, with holes to carry 24 condensers or resistors.
ASK FOR X/H982 — 6d. each — Or 3 for 1/6, post paid. — POST 3d.

PAXOLIN WAFER ROTARY WAVE-CHANGE SWITCH

3 wafers each, 2 pole, 5 way. Dim.: 3½in. x 2½in. 2in. Spindle projects, 1⅛in., single hole mtg.
ASK FOR X/H975 — 2/6 each — Or 3 for 7/6, post paid — POST 6d.

CORD DRIVE SPINDLE. Ratio 6-1

Reverse vernier drive, i.e., cord runs outside chassis.
ASK FOR X/H976 — 1/- each — Or 3 for 3/-, post paid — POST 3d.

I.F. TRANSFORMER. 465 Kc/s. Standard type.

Dim.: 3½in. x 1⅛in. x 1⅛in., pigtail and plain A.D.T.
ASK FOR X/H977 — 10/6 per pair — Or 3 pairs for 27/6, post paid — POST 1/-

I.F. TRANSFORMER. 465 Kc/s. Miniature type.

Dim.: 2½in. x 1½in. x 1in., plain, permeability tuned.
ASK FOR X/H978 — 10/6 per pair — Or 3 pairs for 27/6, post paid — POST 1/-

OUTPUT TRANSFORMER

Standard Pentode type, 3 to 5,000 ohms. 2½in. x 2in. x 1½in. approx., various.
ASK FOR X/H970 — 1/11 each — Or 3 for 5/6, post paid — POST 1/1

Order direct from :—

CLYDESDALE SUPPLY CO. LTD. 2, BRIDGE STREET, GLASGOW · C.5

Phone : South 2706/9.

RADIO TELEVISION

MONEY BACK GUARANTEE
GOODS OF QUALITY
PROMPT DESPATCH

BARTON'S (Radio) LIMITED

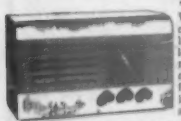
42 · TOTTENHAM COURT ROAD, LONDON · W.1.

RECORDS RECORD PLAYERS

TERMS OF BUSINESS: Cash with order (or C.O.D. Post Items only); all orders for small items totalling over £2 post free unless otherwise stated.

NOW OPEN ALL DAY SATURDAYS 9—5 p.m. WEEKDAYS 9—5 p.m. except THURSDAYS 9—1 p.m. Telephone : LANGHAM 1151/2

BUILD YOUR OWN RADIO!



We can supply all the parts (including valves, 8in. moving coil speaker, cabinet, chassis and everything down to the last nut and bolt) to enable YOU to build a professional-looking radio. The chassis is punched and drilled ready to mount the components. There is a choice of any of three attractive cabinets 12in. long, 8in. wide by 6in. high, as follows: either ivory or brown bakelite, or wooden, finished in walnut. Complete and easy-to-follow point-to-point and circuit wiring diagrams supplied.

MODEL 1 T.R.F. RECEIVER

This is a 3-valve plus metal rectifier T.R.F. receiver with a valve line-up as follows: 6K7 (HF), 6J7 (Det.) and 6V6 (Output). The dial is illuminated and when assembled the receiver presents a very attractive appearance. Coverage is for the Medium and Long Wave Bands. Operates on 200/250 volts A.C. Mains.

Plus 2/6 Packing, Carriage, Insur. **£5 . 10 . 0**

MODEL 2 SUPERHET RECEIVER

This is a powerful midget 4-valve plus metal rectifier Superhet Receiver with a valve line-up as follows: 6K8, 6K7, 6Q7, 6V6. The dial is illuminated and coverage is for the Short Wave bands between 16-50 metres, the Medium Wave bands between 190-450 metres, and the Long Wave bands between 1,000-2,000 metres. Operates on 200/250 volts A.C. Mains.

Plus 2/6 Packing, Carriage and Insur. **£7 . 19 . 6**

T.R.F. RECEIVER We can supply this Receiver ready built at £6/15/6, plus 2/6 p.c.

ALL COMPONENTS SUPPLIED ARE GUARANTEED FOR ONE YEAR

NOTE: *We would respectfully suggest to those interested in building this receiver that they send for OUR Instruction Booklet. Intending constructors can then judge for THEMSELVES how comprehensive this Booklet is.* Instruction Booklet and priced Parts List available separately at 1/-. This money will be refunded if circuit diagram is returned as NEW within 7 days.

HIGH QUALITY AC-DC AMPLIFIERS—Unused BRAND NEW!

—AT A FRACTION OF THE MANUFACTURER'S COST!

These amplifiers are made to an amazingly high standard of workmanship.

Brief specification: Push-pull output (approximately 3 watts). Valve line-up: four latest type miniature Mullard valves—1 UCH42, 1 UAF41 and 2 UL41 in push-pull. A special feature of this is that a separate smooth H.T. supply is incorporated to enable an R.F. tuner unit to be powered by the amplifier. Overall dimensions 9in. x 6in. x 4in.

TWO MODELS AVAILABLE
For operation on 100-110 A.C.-D.C. **65/-**
For operation on 200-250 A.C.-D.C. **69/6**
Packing, carriage and insurance on each model 5/6.

SUPPLIED COMPLETE WITH CIRCUIT DIAGRAM.

4 watt AMPLIFIER KIT

This is a 3-valve 3-stage Amplifier for use with Gramophone, Microphone or Radio. Valve line-up is as follows: 6SL7, 6V6, 5Z4. Negative feed-back. Tone control. Voltage adjustment panel incorporated. 4 watts output. For operation on A.C. Mains 200/250 volts.

The complete Kit, which includes every item down to the last nut and bolt, drilled and punched chassis, and comprehensive point-to-point wiring circuit diagram.

ALL COMPONENTS SUPPLIED ARE GUARANTEED FOR ONE YEAR

PRICE **£4 . 5 . 0** *Plus 2/6 PACKING, CARRIAGE & INSUR.*

The Output Transformer supplied is for use with a loud-speaker of 3 ohms impedance, and we would suggest that the output of the completed amplifier justifies the use of one of the latest W.B. H.F. Speakers which can be supplied as follows: 8in., 60/6; 9in., 67/-; 10in., 73/6. All plus 2/6 pkg., carr. ins.

Circuit Diagram only, available separately at 1/-.

To those who require this Amplifier ready-built we can supply it at £5/1/-, plus 3/6 pkg., carr., ins.

ALPHA CATALOGUE

Send 6d. in stamps for our NEW CATALOGUE
Hot from the Press with Hundreds of Bargains for you

Special Purpose VALVES

CV509	7/6	VU111	3/6
VR54	2/6	9001	6/3
7Q7	8/6	VU39	5/6
VS68	4/-	VR65A	3/6
6G6G	6/6	956	3/6
9004	6/3	9003	6/9
VR136	7/-	2X2	5/6
VR66	3/9	VR65	3/9
VU120A	3/6	6S87	2/-
9002	6/3	1A5GT	7/6
VR53	7/6	220VSG	6/9
VR91	6/-	931A	6/9
807	8/-	2A7	6/-
5Z3	8/6	6A3	5/9
955	4/-	7475	4/9
TT11	6/6	19	6/-
VR116	4/-	26	6/-
VR56	7/-	27	6/-
954	2/-	30	6/-
CV71	1/-	36	6/-
VR137	5/-	84	6/-
VR55	7/3	6L6	6/-
6SA7	9/-	2A5	6/-
ATP4	6/9	CV287	6/-

HEADPHONES
Type CLR Low resistance 120Ω, 7/6 pair.
Type CHR High resistance 4,000Ω, 11/- pair.
Type DHR, a super job, 13/9 pair.
Headbands, wide type, 1/9 ea.
Headphones, by Trimm Radio Mfg. Co., Chicago, U.S.A., 1,200Ω each earpiece light headband complete with lead and Igranic jack plug, 13/6 pair.

MAINS TRANSFORMERS
3-way Mounting Type.
MT1. Primary 0-210-230-250 v. Secondary, 250-0-250 v. 80 mA. 6.3 v. 4 amps., 5 v. 2 amps., with taps at 4 v. on filament windings. Price 17/6 each.
MT2. Primary 0-210-230-250 v. Secondary 350-0-350 v. 80 mA., 6.3 v. 4 amps., 5 v. 2 amps. Both filament windings tapped 4 v. Price 17/6 each.
MT3. 20 volt 2 amp. tappings at follows: 3, 4, 5, 6, 8, 9, 10, 13, 15, 18 20, 24 v. 17/6 each.

LOUDSPEAKER UNITS
3in. Plessey Roundtype for portables, 12/9 each.
Elac, 3½in. Square type speaker, 2 to 3Ω, 13/6 ea.
Plessey 5in. unit, 13/6 ea.
Elac 4in. unit with 5in. fitting, 13/6 ea.
Elac 6½in. unit, 14/6 ea.
Lectrona and R. & A., 8in. units, 16/6 ea.
10in. Plessey lightweight, 19/6 ea.
10in. Elac, 22/6.
10in. Goodmans, 29/6.
8in. Lectrona, with output transformer, 20/-.
Truvox R3X11, 12in. unit, 49/6.
Truvox wafer speaker, 6½in., 20/-.
Plessey 8in. mains energised, 1,500Ω field, 21/-.
6½in. unit with 1,500Ω field, 17/6.
5in. Goodmans PM unit, 14/9.

PORTABLE RECORDING OR PROJECTOR CASES.
Rexine covered. (Ready for carrying 15in. × 9½in. × 13in.). Internal dimensions, 14in. long, 11½in. deep, 5½in. front height, 8½in. rear height. Weight 8½lb. Price 13/6 each. Postage and Packing 2/-.

SPECIAL OFFER
CO-AXIAL CABLE
Best quality grade "A" cable solid 1/022 70 ohms, 7½d. yd.
Best quality Grade "A" cable stranded 7/0076, 8½d. yd.
Best quality Grade "A" cable air spaced 1/036, 1/- yd.

SOLDERING IRONS
Solon type 964, fitted Oval Bit ..... 19/11 ea.
Solon type 968, fitted Pencil Bit ..... 19/11 ea.
Both types are complete with approx. 6ft. of Henley 3-core cable and are suitable for 230/250 v.

HAND MICROPHONE by "REGENT," complete with screened lead and plug—Crystal insert, nickel chrome plated head, listed at 3 gns. Our price, 21/- each.

TYPE 6 INDICATOR UNITS
These units recommended as a basis for the Simplex TV receiver are brand new and contain the VCR97 tube. EF50, EB34, Valves, Volume Controls, resistors, condensers, suitable tag panels, etc., etc. Cut your construction costs at this special price, 59/6 plus 5/6 carriage.

ENGRAVED KNOBS.
Control Knobs clearly engraved in gold.
Size "A" diameter 1¾in.; Size "B" diameter 1¼in. Both in two colours, Walnut or Cream. Inscriptions available:
RADIO: "Volume," "Vol./On/Off," "Wavechange," "On/Off," "Tuning," "SML Gram," "Radiogram," "Tone."
TELEVISION: "Contrast," "Brilliance," "Brilliance On/Off," "Focus," "Brightness."
AMPLIFIER: "Treble," "Bass" (Plus any above).
TAPE RECORDER: Record/Play.
Prices: Size "A" 1/6; "B" 1/2. Plain knobs can be supplied in either size, 1/- each and 9d. each respectively.

SOLDERING PASTE
Large tin soldering paste by Tyne Chemical Co. Approx. 1 lb., 1/6 per tin.

CONDENSERS
The following is a selection from our stocks of manufacturers' surplus condensers, all by well-known makers.
Aluminium Can types, Clip fixing

8 × 8 mfd. 450 v.	4/-
8 × 16 mfd. 450 v.	4/-
8 × 24 mfd. 350 v.	3/-
8 × 32 mfd. 475 v.	3/9
12 × 4 mfd. 450 v.	2/-
16 mfd. 450 v.	2/-
16 × 8 mfd. 350 v.	3/-
16 × 16 mfd. 350 v.	3/3
20 × 20 mfd. 500 v.	4/9
24 mfd. 450 v.	2/9
25 × 16 mfd. 350 v.	3/6
32 × 8 mfd. 350 v.	3/6
32 × 16 mfd. 350 v.	4/6
32 × 32 mfd. 450 v.	6/11
32 × 32 × 8 mA. 350 v.	5/6
32 × 32 mfd. 350 v. 25 mA. 25 v.	5/9
64 mfd. 350 v.	2/-

YAXLEY SWITCHES

1 bank switching 2 p. 2 w. and 2 p. 1 w. and a Mains On/Off Switch	1/6 ea.
2 bank 4 pole 3 way	1/6 ea.
2 bank switching 3 p. 2 w. and 1 p. 3 w.	1/6 ea.
1 bank 2 pole 5 way	1/6 ea.
1 bank 4 pole 1 way	1/6 ea.
1 bank 3 pole 4 way	1/6 ea.
2 bank 2 pole 7 way	1/6 ea.
1 pole Changeover	1/- ea.
2 pole Changeover	1/3 ea.
1 pole 4 way	1/6 ea.
1 pole 7 way	1/6 ea.
1 pole 8 way	1/6 ea.
3 pole 3 bank 2 way	1/6 ea.
4 pole 3 way (long spindle new type)	2/6 ea.
4 pole 2 way	1/9 ea.

"RECTAFORMA" BATTERY CHARGER
Size 10in. × 8in. × 7in., in grey crackle case with switch for switching to either 6 v. or 12 v. at half or full charge. Two fuses are also incorporated, a 1 amp. fuse for mains and a 5-amp. fuse for L.T. and are accessible from outside, a mounted ammeter is also affixed, to show rate of charge. Price £4/4/-.

"CLEM" TRAVELLING IRON WITH ASBESTOS STAND
Size 4in. × 2½in. × 2½in. including handle, complete with lead and switch to enable it to be used on any voltage between 110 and 250 v. A.B.C. adaptor is fitted to the lead (Colour as available, Blue, Green, etc.) Price £1/1/-.

★★★★★★★★★★

"COLLARO" AC37 GRAMOPHONE MOTOR
Governor controlled to run at 78 r.p.m., suitable 100/125 v. and 200/250 v. Complete with 10in. turntable. Price 46/-. Post and Packing 2/6.

★★★★★★★★★★

THE ALPHA AMPLIFIER
3 valves (6B8G, 6V6GT, 6X5GT) A.C. mains fully isolated neg. feed back (voltage and current), controlled volume and tone, dual input network, for modern crystal or Hi-Fi mega. Less than 1 per cent. total 2nd and 3rd harmonic distortion at 3 watts output from 1,000 C.P.S. Complete ready for use. 79/6 post extra.

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 9d.; 20/- add 1/-; 40/- add 1/6; £5 add 2/- unless otherwise stated. Minimum C.O.D. fee and postage 2/6.

MAIL ORDER ONLY

PORTABLE RADIO ATTACHE CASE

available in the following colours:
- LIZARD GREY
- MAROON
- BLUE
- BROWN

complete with facia board and removable insert in lid for frame aerial.

PRICE
36/6
ONLY

We can supply components for making a 4-valve Superhet to fit the above case and a circuit diagram and full instructions available at 2/- each. Details of a few of the items required are as follows:—

Chassis, 3/- each.
Midget IF Transformers, 8/6 a pair.
Dial, 1/3 each.
.0005 Midget 2 gang Condenser, 11/-.

METAL RECTIFIERS, ETC.

12 volt ½ amp.	1/6 ea.
8 volt 1 amp.	2/- ea.
250 volt 45 mA.	6/6 ea.
250 volt 75 mA.	7/6 ea.
300 volt 60 mA.	7/6 ea.
Full Wave 12 volt 1 amp.	4/9 ea.
12 volt 2 amp.	8/6 ea.
12 volt 3 amp.	13/6 ea.

SEN-TER-CEL SELENIUM RECTIFIERS

Type RM1 135 v. 60 mA.	4/3 ea.
,, RM2 130 v. 100 mA.	4/9 ea.
,, RM3 125 v. 120 mA.	5/3 ea.
,, RM4 260 v. 250 mA.	16/- ea.

PENCIL RECTIFIERS

Type	Maximum Transient Inverse Peak Voltage	Peak Pulse Input Voltage	Half-Wave	Doubler	Tripler	Price
K3/25	2,125	2,000	1,950	3,700	5,000	5/5
K3/45	3,450	3,200	3,000	6,750	7,800	7/6
K3/45	3,825	3,600	3,500	6,250	8,400	8/2
K3/50	4,250	4,000	3,850	6,750	9,250	8/8
K3/60						9/6
K3/100	7,650	7,200	6,500	13,700	16,700	14/8

MULTICORE SOLDER
Contains 3 cores of extra active non-corrosive Ersin Flux. Size 1. 5/- per carton.
Carton colour red and black, Alloy 60/40 SWG18.
Carton colour green and black, Alloy 40/60 SWG16.
Size 2/6 per Carton.
Containing 18 SWG 40/60 Alloy Ersin Multicore. Solder sufficient for 200 average joints.

(B.R. Range)

BR.850 8 mfd. 500 v.	ea.	2/9
BR.1650 16 mfd.	ea.	3/3
BR.3250 32 mfd. 500 v.	ea.	3/6
8 × 8 mfd. 500 v.	ea.	4/-
BR.501 50 mfd. 12 v.	ea.	1/9

Midget Metal Types

2 mfd. 350 v.	1/9
8 mfd. 350 v.	1/1
8 × 8 mfd. 450 v.	2/-
8 × 8 mfd. 450 v.	2/9
16 mfd. 350 v.	2/9
16 × 8 mfd. 450 v.	4/-
16 × 16 mfd. 450 v.	4/6
16 × 24 mfd. 350 v.	4/9
24 mfd. 350 v.	2/9
32 mfd. 350 v.	1/9
32 × 32 mfd. 350 v.	4/9
220 mfd. 12 v.	1/6

Wire ended Types

8 mfd. 450 v. Cardboard covered	1/11
50 mfd. 450 v.	3/9

Bias Condensers
Tag ended metal types

12 mfd. 50 v.	1/-
25 mfd. 25 v.	1/3
50 mfd. 12 v.	1/-
50 mfd. 50 v.	2/6
100 mfd. 12 v.	1/9
100 mfd. 25 v.	1/9

Wire ended Types. Cardboard covered

25 mfd. 25 v.	1/9
50 mfd. 12 v.	1/9
60 mfd. 50 v.	2/3

ALPHA RADIO SUPPLY CO.

5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS 1.

WHEN ORDERING PLEASE QUOTE "DEPT. W.W."

RADIO TRADERS LTD.

23 WARDOUR ST., LONDON, W.1. (Coventry Street end)

Phone No. GERrard 3977/8 *Grams: "Radiotrade"*

PAXOLIN SHEET

18in. x 4½in. x ⅛in. ..... 1/- each 10in. x 10in. x ⅛in. ..... 1/6 each
20in. x 10in. x $\frac{1}{16}$in. ..... 1/6 ,, 20in. x 10in. x ⅛in. ..... 3/- ,,

CONDENSERS Per doz.

2 Mfd. 150 v. Tubular Paper (aluminium tubes), 1/6 each 15/-
8 Mfd. 450 v. Electrolytic, 1/9 each 18/-
16 Mfd., 350 v., Electrolytic, 2/- each 21/-
24 Mfd., 350 v., Electrolytic, 2/- each 21/-
32 Mfd. 450 v. Electrolytic, 2/6 each 27/-
8 x 16 Mfd., 350 v., 1/6 each 15/-
20 x 20 Mfd., 275 v., Electrolytic, 2/9 each 30/-
16 x 16 Mfd., 350 v., Electrolytic, 2/6 each 27/-
16 x 24 Mfd., 350 v., Electrolytic, 2/6 each 27/-
16 x 8 Mfd. Metal Cans Electrolytic, 350 v., 1/6 each 15/-
32 Mfd. Metal Cans Electrolytic, 350 v., 1/6 each 15/-
32 x 8 Mfd. Metal Cans Electrolytic, 275 v., 1/9 each 18/-
64 Mfd. Metal Cans Electrolytic, 350 v., 2/6 each 24/-
Condenser clips for above 3/-
100 Mfd. 50 v. Metal Cans, 1/- each. 25 Mfd. 50 v. Tubular Cardboard 10/6
50 Mfd. 12 v., 1/- each 10/6
12 Mfd. 50 v. Tubular Paper (aluminium tubes), 1/- each 10/6
100 Mfd. 6 v. Tubular Paper (aluminium tubes), 1/- each 10/6
.00005 Tubular Miniature, 4/- per doz. .02, 500 v., 4/- per doz., .001, 350 v. 4/- per doz. .05, 350 v., 4/- per doz. .005, 200 v., 4/- per doz.

MIDGET MICA CONDENSERS: .0001, .0002, .0003, .0004, .0005 4/-
200 Assorted Moulded Micas. Popular Values £2 10 0
200 Assorted Silver Micas. Popular Values £2 10 0
200 Assorted Carbon Resistors: ½, ¼ and 1 watt. Good selection £1 10 0

CARBON RESISTORS: ½ watt 2/6; ¼ watt 3/-; 1 watt 4/-; 2 watt 6/-; 5 watt 9/- per doz.

HIGH STABILITY RESISTORS:

Tolerance:	1%	2%	5%
¼ watt	1/-	9d.	6d. each
½ watt	1/3	1/-	9d. each
1 watt	1/9	1/3	1/- each
8-40 MEG 2 watt			2/6 each

ALL CINCH COMPONENTS IN STOCK

PYE PLUGS AND SOCKETS ..... 1/6 pair

W/W AND VITREOUS RESISTORS. 5 watt, 1/6; 10 watt, 2/6; 15 watt, 3/-; 20/30 watt, 3/6 each.

W/W V/CONTROLS. COLVERN and B-NSF. 5K PRESET and other values. 2-3 watt, 2/- each. 10K Isolated Spindle ..... 2/- ,,
500 ohms, 1K, 20K, 25K, 50K, with spindle ..... 3/- ,,

V/CONTROLS WITH SWITCH: most values, B-NSF ..... 2/6 ,,

V/CONTROLS: Less Switch, Preset and Spindle. MOST VALUES ..... 1/9 ,,

TWIN MIDGET GANGS, .0005, with trimmers, PERSPEX COVER ..... 5/6 ,,

4-WAY PUSH BUTTON UNITS, 1/6 each ..... 15/- doz.

PUSH BUTTON KNOBS ..... 3/- ,,

TAG STRIPS: 3-way, 2/- doz.; 4-way 2/6 doz.; 5-way, 3/- doz.; 7-way 4/- doz.; 28-way 10/- doz.

ASSORTED PILOT LAMP HOLDERS ..... 4/- ,,

FUSES 1¼in. Most values from 750 mA. to 10 amp. ..... 2/- ,,

POINTER KNOBS. Small black, with line, ¼in. hole ..... 7/6 ,,

STANDARD ROUND KNOBS: Small, ¼in. hole, 6/-; Large, ½in. hole, 7/6; with spring clip, ¼in. hole ..... 4/6 ,,

CLIX WANDER PLUGS, Type MP2. Red, black, blue ..... 2/- ,,

PHILIPS TRIMMER TOOLS ..... 1/- each

BELLING & LEE. P/M FUSE HOLDERS, Type L356 ..... 2/6 ,,

WEARITE COILS: Types PA4, PO4, PA5, PO5, 1/3 each ..... 12/- doz.

VALVE HOLDERS: Moulded. **B9A,** 7/6; **B7G,** 6/-; **EF50,** 6/-; **ENGLISH OCTAL,** 3/- per doz. **SCREEN CANS** for B9A, B7G, 6/- doz.; **PAXOLIN**—B7G, MAZDA 4-pin UX ..... 3/- ,,

BELLING & LEE. PLUGS AND SOCKETS. Ex-Govt. BRAND NEW 5-pin, Chassis and Cable, 7-pin ..... 1/6 pair

BULGIN. P73, Plug and Socket, 2/9 each; P74, Plug and Socket, 2/6; P200, Plug and Socket, 2/-; Rotary Switches, S.255, 2/-; Dolly Switches, S.267, 2/-; Dolly Switches, S.259, 1/6; Standard Switches, Ex-Govt., On-off ..... 1/6 each

POST OFFICE LAMP JACKS, No. 10, 1/- each ..... 9/- doz.
Lamp Covers for same ..... 3/- ,,

L.F. CHOKES, 300 w., 60 mA. CHS ..... 4/6 each

OUTPUT TRANSFORMERS. Multi Ratio, 5/-; Pentode or Power ..... 4/- ,,

VALVE SCREEN CANS for Standard Valves, 1/- each ..... 10/6 doz.

DRUM DRIVES, 4½in. ..... 1/- each

WESTECTORS. WX6, WX12, W1, W12, W4, 1/- each ..... 9/- doz.

ARCOLECTRIC (Whitney Lamp). Red, green, clear, 1/6 each 15/- ,,

SIGNAL LAMP HOLDERS P/M, complete with adjusting lamp holders, 1/9 each ..... 18/- ,,

AIR SPACE TRIMMERS. Preset and spindle types, 5PL, 10PF, 15PF, 20PF, 25PF, 50PF, 75PF, 15/-; 100PF Preset, 1/6 each 15/- ,,

JONES PLUG AND SOCKETS. 4-pin, 2/6; 6-pin, 3/-; 8-pin, 3/6; 10-pin, 4/-; 12-pin ..... 6/- pair

NUTS. 6BA, 3/-; 6BA, 2/6; 4BA, 3/-; 2BA 4/-gross

SOLDER TAGS, 1/6 gross. **SHAKEPROOF WASHERS** ... 2/- ,,

WASHERS, 2, 4 and 6BA ..... 1/- ,,

SHAKEPROOF SOLDER TAGS, 4BA and 6BA, 2/-; 2BA ..... 2/3 ,,

CASH WITH ORDER OR C.O.D **ALL ORDERS DEPT. W.1**
ALL ORDERS FOR LESS THAN 5/- ADD POSTAGE

REDUCED PRICES FOR GROSS LOTS

We invite your enquiries for items not listed.

Trade Counter open 9.30 to 5.30 Monday to Fridays. Callers Welcomed.

WHOLESALE, MANUFACTURERS' AND EXPORT ENQUIRIES INVITED.

For Quality Bargains Always

—Best Buy at Britain's

G.E.C. DIODE VOLTMETER. Consists of a 3½in. 0-100 Micro-amp meter mounted in a neat black crackle instrument case size 7½in. x 4in. x 3in. deep. The meter is calibrated 0-100 and 0-300 volts and a range switch is incorporated, as well as mains on/off switch, panel indicator light and filament transformer. The instrument was intended for use with an external probe (which is not available). Circuit of the instrument and probe supplied. BRAND NEW AND BOXED AND A BARGAIN AT ONLY **79/6.**

INDICATOR UNIT TYPE 182A. Contains 3-EF50, 1-5U4G, 4-5P61, and 6½in. C.R.T. type VCR 517. This tube will replace the VCR 97 without any alteration, is completely free from cut-off and has a more pleasant tube colour. Contains in addition a very large assortment of pots., resistors, condensers, etc. Tubes demonstrated. Supplied Brand New (less relay) for only **67/6,** plus **7/6** carr. In original transit case. Original circuit supplied free with each order, or **1/6** separately. Conversion of this unit to an oscilloscope is being described in the "Radio Constructor."

TYPE 12 TRANSMITTER. Mains operated transmitter covering 1.2 to 17.5 Mc/s in four bands crystal or V.F.O. Size 24in. x 12½in. x 17½in. weight 134 lbs. Complete with all valves, ready for operation. In first class condition and tested before despatch, with circuit and instructions ONLY **£16/16/-** plus 14/- carr. We have a few other types of transmitters at bargain prices for callers only.

UNIVERSAL AVO METERS, MODEL 40. Once more we are able to offer a further supply of these—very little used, thoroughly checked and tested. First class multi-range test meter for ONLY **£9/19/6.**

METER BARGAINS (all brand new and boxed).

15 volt (50 cycle) Moving Iron, 2½in. flush pnl. mtg., **10/-.**
20 Volt Moving Coil, 2in. sq. panl. mtg., **7/6.**
3,500 Volts Moving Coil, 3½in. projection, **15/-.**
150 Milli-Amp. 2in. sq. panel mtg., **7/6.**
5 Milli-Amp. Moving Coil 2in. sq. pnl. mgt., **7/6.**
200 Milli-Amp. Moving Coil 2½in. dia. flush pnl. mtg., **10/6.**
20 Amp. Moving Coil 2½in. dia., **7/6.**
1 Milli-Amp. 2½in. barrel, flush pnl. mtg., **22/6.**
1 Milli-Amp. 2½in. barrel, desk type in sloping front case, **25/-.**
100 Micro-Amps. 2½in. barrel, flush panel mtg. Scaled 0-1,500 in 15 clear divisions. **ONLY 42/6.**
500 Milli-Amp. Thermo-couple 2in. square panel mtg., **5/-.**

METER RECTIFIERS Salford Instrument, full wave bridge type. Brand new 1 mA. at 11/6, and 5 mA. at **8/6.**

BLOCK CONDENSERS. These are Nitrogol type with ceramic insulating terminals.

8 mF. 2,000 volt working size 5in. x 3½in. x 4½in. high at **12/6** each.
4 mF. 2,000 volt working size 3½in. x 2½in. x 4½in. high at **7/6** each.
4 mF. 1,250 volt working size 3½in. x 2½in. x 4½in. high at **5/6** each.

TRANSFORMER BARGAINS. Brand new transformers, ex-manufacturer's surplus, drop through. Primary 200/250 volt, 50 cps.. Secondary 310-0-310 v. 70 mA., 6.3. 3 amps 4 v. 2 amps—can be used with 4 volt or 6.3 volt rectifier. Only **9/6** plus **1/6** post. A similar type transformer 325-0-325 100 mA. 6.3 4 amps, etc. can be supplied to callers only at **14/6.** Filament transformer. Standard tapped primary 12 volts 1½ amps., 4 volts 1½ amps. Only **7/6** each.

E.M.I. OUTPUT METER

E.M.I. OUTPUT METER

just arrived this month a very useful output meter. The instrument itself has a basic movement of 1 mA and incorporates a full-wave instrument rectifier. There are two ranges 0-500 milliwatts and 0-5 watts and also a decibel scale. The input impedance is 5,000 ohms. These are all BRAND NEW AND UNUSED in sealed individual Manufacturers cartons, complete with instructions and are offered at about a third of list price. Only 35/- each plus 1/6 post.

METER RECTIFIER. Full wave bridge 2 mA. by S.T.C. as used in the above instrument. Brand new Only **5/6** each..

GRAYSHAW RESISTANCE CAPACITY BRIDGES. We are London Stockists for these fine instruments which represent excellent value at **£6/19/6.** We can thoroughly recommend these as being superlative value comparing well with far more expensive equipment.

H.R.O. 6-VOLT VIBRATOR PACK. Gives 150 volts 80 mA. smoothed D.C. Uses Mallory vibrator, 6X5, heavy duty smoothing chokes, etc. In black crackle cabinet size 7in. x 7in. x 6in. Brand new, only **29/6.**

U.S.A. DYNOMOTOR. 12 volts D.C. input, 250 volts 60 mA. output. Weight 2½ lb. Size 4½in. x 3in. dia. Ideal for car radio, mobile amplifiers, small transmitters, etc. All tested prior despatch. ONLY **22/6,** post paid.

CHARLES BRITAIN (Radio) Ltd.

11 UPPER SAINT MARTIN'S LANE
LONDON, W.C.2 *TEM 0547.*

One minute from Leicester Square station (up Cranbourn Street).
Shop Hours: 9-6 p.m. (9-1 p.m. *Thursday.*) *Open all day Saturday.*

MAINS TRANSFORMERS

Primary, 200-250 v. P. & P. 2/-.

~~200-0-200~~ 100 mA., 6 v. 3 amp., 5 v. 2 amp., 22/6.

~~Drop thro'~~ 250-0-250 v. 70 mA., 6 v. 2.5 amp., 5 v. 2 amp., 14/6.

~~Drop thro'~~ 250-0-250 v. 80 mA., 6 v. 3 amp., 5 v. 2 amp., 14/6.

~~200-0-200~~, drop through, 80 mA., 6 v. 3 amp., 5 v. 2 amp., 14/6.

~~250-0-250~~ 80 mA., 6 v. 4 amp., 16/-.

Drop thro' 280-0-280, 200 m.A., 6 v. 3 amp., 5 v. 3 amp., 27/6.

Drop thro' 270-0-270 80 mA., 6 v. 3 amp., 4 v. 1.5 amp., 13/6.

Drop thro' 270-0-270 60 mA., 6 v. 3 amp., 11/6.

Auto Trans. Input 200/250. H.T. 350 v., 250 mA. Separate L.T. 6.3 v., 7 a., 6.3 v. 1½ amp., 5 v. 3 amp., 25/-. P. & P. 2/-.

Heater Transformer. Pri. 230/250 v., 6 v. 1½ amp., 6/-; 2 v. 2½ amp., 5/-.

Mains Transformer, fully impregnated, input 210, 220, 230 and 240. Sec. 600-0-600, 275 mA., and 200 v. at 30 mA., complete with separate heater transformer. Input 210, 220, 230, 240. Sec. 6.3 v. 2 amp. three times, 0, 4, 6.3 v. at 3 amp. and 5 v. 3 amp., 45/-. P. & P. 5/-.

Mains Transformer, fully impregnated, input 210, 220, 230, 240. Sec. 350-0-350, 100 mA. with separate heater transformer. Pri. 210, 220, 230, 240. Sec. 6.3 v. 2 amp., 6.3 v. 3 amp., 4 v. 6 amp. and 5 v. 2 amp., 30/-. P. & P. 5/-.

MAINS TRANSFORMERS, chassis-mounting, feet and voltage panel Primaries 200/250:

~~250-0-250~~ 75 mA. 6.3 v. 3 a. tap 4 v. 6.3 v. 1 a., 13/6.

~~250-0-250~~ 70 mA. 4 v. 5 a., 4 v. 2.5 a. C.T., 18/6.

~~250-0-250~~ 125 mA. 4 v. C.T. 4 a., 4 v. C.T. 4 a., 4 v. C.T. 2.5 a., 27/6.

~~250-0-250~~ 250 mA. 4 v. C.T. 5 a. 4 v. C.T. 5 a., 4 v. C.T. 4 a., 39/6.

Din. T.V. Cabinet, front in contrasting walnut veneers, size 16½in. long, 11½in. high, by 12½in. wide. Complete with two pieces expanded aluminium in gold, 12×9in. and 3in. speaker baffle, 15/-, post paid.

P.M. SPEAKERS (closed field):

	with trans.	less trans.
2½in.	—	15/6
3½in.	—	13/6
5in.	16/6	12/6
6½in.	16/6	12/6
8in.	18/6	15/-
10in.	—	19/6

6½in. M.E. Speaker. 1,000 ohm field, 15/-.

R. & A. T.V. Energised 6½in. Speaker, field coil 175 ohms. Requires a minimum 150 mA. to energise, maximum current 250 mA., 9/6. P. & P. 2/6.

Extension Speaker Cabinet, in contrasting walnut veneer, size 15×10½in. Will take 6½ or 8in. speaker, 17/6.

Completely built All-dry Mains Unit by famous manufacturer, 200/250 v. Metal case size 5×5×3in., incorporating Westinghouse metal rectifiers, 3 500 mfd., 16×24 mfd., mains trans., 2 smoothing chokes, output 90 v. 10 mA., 1.4 v., 0.25 amp., 39/6. P. & P. 2/6.

Volume Controls. Long spindle less switch, 50K, 500K, 1 meg., 2/6 each. P. & P. 3d. each.

Volume Controls. Long spindle and switch, ¼, ½, 1 and 2 meg., 4/- each; 10K and 50K, 3/6 each. ¼ and 1 meg., long spindle double pole switch, miniature, 5/-. P. & P. 3d. each.

Trimmers, 5-40 pf., 5d.; 10-110, 10-250, 10-450 pf., 10d.

~~Twin-gang .0005~~ Tuning Condenser, 5/-. With trimmers, 7/6.

Line Cord, 2-way 0.3 amp., 60 ohms per foot, 1/3 per yard.

Twin-Gang .0005 with feet, size 3½×3×1¼in., 6/6.

~~3-gang .0005~~, with feet, size 4½×2×1¼in., 7/6.

T.V. Coils, moulded former, iron-cored, wound for re-winding purposes only. All-can 1½×1½in., 1/- each, 2 iron-cores all-can 2½×1½in., 1/6 each.

Used Metal Rectifier. 250 v., 150 mA., 6/6.

Metal Rectifier. 250 v., 250 mA., 12/6.
Metal Rectifier. 230 v., 40 mA., 6/-.

PERSONAL ROPPERS ONLY. No. Enlarger, 17/6; 12in., 27/6.

Germanium Crystal Diode, 1/6, post paid.

Television Masks. White Rubber 9in. with glass, 7/6. Cream Rubber, 12in., with armour-plate glass, 15/-.

D. COHEN

RADIO AND TELEVISION COMPONENTS

Terms of Business: Cash with order. Despatch of goods within 3 days from receipt of order. Where post and packing charge is not stated please add 1/6 up to 10/-, 2/- up to £1, and 2/6 up to £2. All enquiries, S.A.E., lists 5d. each.

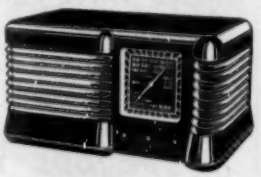
SPECIAL NOTE: NO GOODS SENT WHERE CUSTOMS DECLARATION IS APPLICABLE.

23 HIGH STREET (Uxbridge Road) ACTON, W.3. Telephone: ACOrn 5901.

Hours of Business:
Saturday 9—5 p.m. Wednesday 9—1 p.m. Other days 9—4.30 p.m.

Used 12in. C.R. Tube, aluminised, E.H.T. maximum 10 Kv., heaters 2-volt, with heater cathode short, guaranteed for 3 months. Complete with rubber mask, Elac P.M. focus unit, scan coils, line line, low frame and frame o.p. trans. £5/10/-, P. & P. 7/6.

HIGH-IMPEDANCE PLASTIC RECORDING TAPE, by famous manufacturer. 600ft. on aluminium spool, 8/-. 1,200ft. on aluminium spool, 17/6, post paid.



CABINET, as illustrated, 11½×6½×5¼in., in walnut or cream, complete with TRF chassis, 3 waveband scale, station names, new waveband, backplate, drum pointer, spring, drive spindle, 3 knobs and back, 23/6. P. & P. 3/6.
AS ABOVE, with superhet chassis, 23/6. P. & P. 3/6.
AS ABOVE, complete with new 8in. speaker to 8k, and O.P. trans., 35/-. P. & P. 3/6.
AS ABOVE, with superhet chassis, 36/-. P. & P. 3/6.
Used metal rectifier, 250 v. 50 mA., 4/6; gang with trimmers, 6/6; M. & L. TRF coils, 5/-; 3 obsolete ex-Govt. valves, 3 v/h and circuit, 6/6; heater trans., 6/-; volume control with switch, 3/6; wave-change switch, 2/-; 32×32 mfd., 4/-; bias condenser, 1/-; resistor kit, 2/-; condenser kit, 4/-. M. & L. superhet Coils with circuit, 6/6; iron-cored 465 I.F.s 7/6; min. gang, 5/6; volume control with switch, 4/-; wave-change switch, 2/6; heater trans., 7/6; 4 v/h, 1/6; 4 obsolete ex-Govt. valves, metal rectifier and Xtal diode with circuit, 14/6; 25×25 mfd., 1/-; 16×16 mfd., 3/3; condenser kit (17), 7/6; resistor kit (14), 3/6.

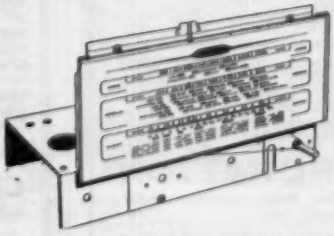
Cyclon 5 channel T.V. Tuner, uses EF80 and 12AT7, less valves, 12/6, post paid.

Radio-gram Chassis, 5 valve A.C./D.C. 3 wave-band superhet 195-555 v., 18-49, 200-550 and 1,000-2,000 metres, I.F. 470 Kc., size of chassis 13×6½×2½in., size of scale 7½×3½in., valve line-up 10C1, 10F9, 10LD11, U404, and 10P14. Twin mains filter input, 2 dial lights and 8in. P.M. £8/17/6. P. & P. 5/-.

COMPLETELY BUILT SIGNAL GENERATOR

Coverage; 120 Kc/s.-320 Kc/s., 300 Kc/s.-900 Kc/s., 900 Kc/s.-2.75 Mc/s., 2.75 Mc/s.-8.5 Mc/s., 8.5 Mc/s.-25 Mc/s., 17 Mc/s.-50 Mc/s., 25.5 Mc/s.-75 Mc/s. Metal case 10×6½×4½in. Size of scale 6½in. x 3½in., 2 valves and rectifier. A.C. mains 230/250 v. Internal modulation 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated. R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Black crackle finished case and white panel, £4/19/6. Or 34/- deposit and 3 monthly payments of 25/-. P. & P. 4/- extra.

CONSTRUCTOR'S PARCEL No. 1 comprising chassis 12½×3×2in., cad. plated 18 gauge, v/h., I.F. and trans., cut-outs, backplate, 2 supporting brackets, 3 waveband scales, new wavelength station names. Size of scale 11½×4½in., drive spindle drum, 2 pulleys, pointer, 2 bulb holders, 5 paxolin international octal valve holders, 4 knobs and pair of 465 I.F.s, 16/6.



AS ABOVE, but complete with 16+16 mfd. 350 wkg. and semi-shrouded drop thro' 250-0-250 60 mA., 6 v., 3 amp. Fri. 200-250, and twin-gang, 31/6. P. & P. 2/-.

CONSTRUCTOR'S PARCEL. As No. 1 plus 16×16 mfd. 350 wkg., semi-shrouded drop-thro' 250-0-250 60 mA., 6.3 v. 3 a., 5 v. 2 a., twin gang, and 6 L.-M.S. superhet coils complete with trimmers and tracking condensers with circuit. £2/5/-. P. & P. 2/6.

Line and E.H.T. Transformer, 14 Kv., using ferrocart core, complete with line and width control, and corona shields. U37 rectifier winding, 35/-.

Line and E.H.T. Transformer, 9 Kv., using ferrocart core complete with built-in line and width control. Mounted on small all-chassis. Overall size 4½×15in., EY51 rec. winding, 27/6.

Scan Coils, low line, low impedance frame, complete with frame transformer, to match above, 27/6. P. & P. 2/-.

Valve Holders, moulded octal Mazda and locta, 7d. each. Paxolin, octal Mazda and locta, 4d. each. Moulded B7G, B8A and B9A, 7d. each. B7G moulded with screening can, 1/6 each.

32 mfd., 350 wkg.	2/-
16×24, 350 wkg.	4/-
4 mfd., 200 wkg.	1/3
40 mfd., 450 wkg.	3/6
16×8 mfd., 500 wkg.	4/6
16×16 mfd., 500 wkg.	5/9
16×16 mfd., 450 wkg.	3/9
32×32 mfd., 350 wkg.	4/-
32×32 mfd., 350 wkg., and 25 mfd., 25 wkg.	6/6
25 mfd., 25 wkg.	1/4
250 mfd., 12 v. wkg.	1/-
16 mfd., 500 wkg., wire ends	1/3
8 mfd., 500 v. wkg., wire ends	2/6
8 mfd., 350 v. wkg., tag ends	1/6
50 mfd., 25 v. wkg., wire ends	1/9
100 mfd., 350 wkg.	2/-
100+200 mfd., 350 wkg.	2/6
16+16 mfd., 350 wkg.	3/3
50 mfd., 180 wkg.	1/9
65 mfd., 220 wkg.	1/6
8 mfd., 150 wkg.	1/6
60+100 mfd., 260 wkg.	2/9
50 mfd., 12 wkg.	1/4
32+32 mfd., min., 275 wkg.	4/-
50 mfd., 50 wkg.	1/9
Miniature wire ends moulded, 100 pf., 500 pf., and .001 .. ea.	7d.

Combined 12in. mask and escutcheon in lightly tinted Perspex. New aspect, edged in brown. Fits on front of cabinet, 17/6.

Frame Oscillator Blocking Trans., 4/6
Tube Mounting Bracket, size 9½×4½in. 12in. tube clamps, 2/-.

CHOKES:
2-20 Hen., 150 mA., 15/-. P. & P. 2/-.
6 Hen., 275 mA., 15/-. P. & P. 2/-.
100 Hen., 40 mA., 15/-. P. & P. 2/-.
Smoothing Choke, 2 henry 150 mA. 3/6; 250 mA., 10 henry, 10/6; 5 henry 250 mA., 60 ohms, 8/6.

P.M. Focus Unit for any 9 or 12in. tube except Mazda 12in., with Vernier adjustment, 15/-.

P.M. Focus Unit for Mazda, 12in., with vernier adjustment, 17/6.

Wide Angle P.M. Focus Units, Vernier adj., state tube, 25/-.

Energised Focus Coil, low resistance mounting bracket, 17/6.

Ion Traps for Mullard or English Electric tubes, 5/-, post paid.

465 Kc. I.F.s, size 2½×1½in. Q.110 removed from American equipment, 5/- per pair. Standard 465 Kc. iron-cored I.F.s, 4×1½×1½in., per pr. 7/6. Wearite standard iron-cored 465 Kc. I.F.s, 3½×1¼×1¼in., per pr. 9/6.

Iron-cored 465 Kc. Whistle Filter, 2/6.

OUTPUT TRANSFORMERS. Standard type 5,500 ohms imp., 4/6; 40-1 with extra feed-back windings, 4/6. Miniature 42-1, 3/3. Multi-ratio 3,500, 7,000 and 14,000, 5/6. 10-watt push-pull, 6V6 matching, 7/-. 90-1 3 ohm speech coil, 6/6.

PUSH-BACK CONNECTING WIRE. Doz. yds., 1/6, post paid.

STANDARD WAVE-CHANGE SWITCHES 4-pole 3-way, 1/9; 5-pole 3-way, 1/9; 2-pole 3-way, 1/9; 9-pole 2-way, 3/6; Miniature type, long spindle 4-pole 4-way, 4-pole 2-way and 4-pole 2-way, 2/6 each. P. & P. 3d.

465 KC. MIDGET I.F.s. Q.130 size 1½in. long, 1in. wide, ¾in. deep by very famous manufacturer. Pre-aligned adjustable iron-dust cores, per pair, 12/6.

Mains Droppers. 0.3 amp., 460 ohms, tapped 280 and 410, 1/6; 0.3 amp., 717 ohms, tapped at 100 ohms, vitreous, 1/6; 0.3 amps., 980 ohms, tapped 700 and 825, 2/6; 0.3 amp., 1,000 ohms, vitreous, tapped, 2/6; Vitreous, 0.3 amp. 700, tapped 600, 640, 660, 3/6. P. & P. on each 3d.

T.V. Width Controls, 3/6.

T.V. Sub Assembly, all-chassis, 12in. × 2½in., with frame osc., line osc., 12 mfd. 275 wkg., Metrosil, 6 condensers, 4 resistors and tag panel, 15/-.

COMMUNICATIONS RECEIVER R1155. The famous ex-Bomber Command Receiver known the world over to be supreme in its class. Covers 5 wave ranges 18.5-7.5 Mc/s, 7.5-3.0 Mc/s, 1,500-600 kc/s, 500-200 kc/s, 200-75 kc/s, and is easily and simply adapted for normal mains use, full details being supplied. Aerial tested before despatch. These are IN EXCELLENT CONDITION IN MAKER'S ORIGINAL TRANSIT CASES, ONLY **£9/19/6.**
A few of the R1155N model can also be supplied. This is the latest version which covers the Trawler Bands, and in addition is fitted with ultra slow motion tuning. Used, but tested working before despatch. ONLY **£17/19/6.**
A factory made Power Pack, Output Stage and Speaker, contained in a black crackled cabinet to match the receiver, can be supplied at ONLY **£5/10/-.** Operates receiver immediately. **DEDUCT 10/- IF PURCHASING RECEIVER AND POWER PACK TOGETHER.**
Please add carriage costs of 10/6 for receiver, and 5/- for power pack

METERS

F.S.D.	SIZE AND TYPE	PRICE
1 milliamp	D.C. 2½in. Flush square	15/-
1 „	D.C. 2½in. Flush circular	22/6
1 „	D.C. 2½in. Desk type	25/-
5 „	D.C. 2in. Flush square	7/6
100 „	D.C. 2½in. Flush circular	12/6
150 „	D.C. 2in. Flush square	7/6
500 „	D.C. 2½in. Flush circular	12/6
500 „	thermo 2in. Flush square	5/-
500 „	thermo 2in. Proj. circular	5/-
20 amps	D.C. 2in. Proj. circular	7/6
40 amps	D.C. 2in. Proj. circular	7/6
30-0-30 amp	D.C. Car type moving iron	5/-
15 volts	A.C. 2½in. Flush, circ., mov. iron	8/6

All meters Brand New in Maker's Cartons.

100 MICROAMPS METERS. 2½in. circular flush mounting. Widely calibrated scale of 15 divisions marked " yards " which can be rewritten to suit requirements. These movements are almost unobtainable to-day and being BRAND NEW IN MAKER'S CARTONS are a snip at ONLY **42/6.**

POWER UNIT TYPE 3. Made for use with the R.1132A, this is a standard rack mounting job to match the receiver, and is for 200/250 v. 50-cycle mains with outputs of 250 v. D.C. 100 mA., and 6.3 v. 4 amp. Fitted with H.T. current meter and voltmeter this is a first-class unit, and can be used for a variety of receivers. Used, but tested working before despatch. ONLY **90/-** (carriage, etc., 5/-). Connecting Cable with Jones Plugs for receiver and power unit, **10/-.**

RF UNITS TYPE 26 and 27. For use with the R.1355 or any receiver with a 6.3 v. supply. These are the variable tuning units which use 2 valves EF54 and 1 of EC52. Type 26 covers 65-50 Mc/s. (5-6 metres), and Type 27 covers 85-65 Mc/s. (3.5-5.0 metres). Complete with valves and BRAND NEW IN MAKER'S CARTONS. ONLY **45/-** each.

AVO MODEL 40 UNIVERSAL TEST METERS. Completely self-contained, and provides 40 ranges of A.C./D.C. current, voltage, and resistance. Have had some use but every instrument has been thoroughly checked and tested and is GUARANTEED IN PERFECT WORKING ORDER. ONLY **£9/19/6.**

OSMOR H.O. COIL PACK. The 3 wave superhet pack recommended for the TR1196 Receiver conversion. ONLY **40/-** 1196 conversion data supplied with coil pack, or separately **1/-.**

500 KCS. CRYSTALS. Standard 2-pin mounting. Ex. new equipment and perfect. ONLY **15/-** (postage, etc., 1/-).

VACUUM PUMPS. For Handymen and Model Makers. Ex-R.A.F. Type 83-Mk. III. BRAND NEW IN MAKER'S CARTONS ONLY **22/6** (post 2/-).

TRANSFORMERS. Manufactured to our specification and fully guaranteed. Upright mounting, fully shrouded, normal primaries
425 v.-0-425 v. 250 mA., 6.3 v. 4 a., 6.3 v. 4 a., 5 v. 3 a., **50/-.**
350 v.-0-350 v. 160 mA., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a., **42/6.**
350 v.-0-350 v. 150 mA., 6.3 v. 5 a., 5 v. 3 a., tapped at 4 v **32/6.**
250 v.-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., **32/6.**
Please add 2/- per transformer postage.

TRANSFORMERS, FILAMENT. 6.3 v. 2 a., **7/6** ; 6.3 v. 3 a., **10/6** (postage 1/-).

TRANSFORMERS, EHT. Upright mounting.
EHT for VCR97 Tube 2,500 v. 5 mA. 2 v. -0-2 v. 1.1 a., 2 v.-0-2 v. 2 a., **37/6.**
EHT 3,500 v. 5 mA., 2 v. 1 a., **72/6.**
EHT 7,000 v. 5 mA., 2 v. 1 a., **82/6.**
EHT 7,000 v. 5 mA., 4 v. 1 a., **82/6.**
Please add 2/- per transformer postage.

ROTARY POWER UNIT TYPE 104. Input 12 v., Output 230 v. 60 mA., and 6.3 v. 2.5 a., Fully filtered and smoothed, and noise suppressed. Ideal for car radio, etc. ONLY **15/-** (postage etc., 2/6).

AMERICAN 12 v. DYNAMOTORS. Output 255 v. 60 mA. ONLY **22/6.**

Cash with order please, and print name and address clearly. Amounts given for carriage refer to inland only.

U.E.I. CORPORATION

Radio Corner, 138, Gray's Inn Road, London, W.C.1
Phone : TERMINUS 7937.

(Open until 1 p.m. Saturdays. We are 2 min. from High Holborn (Chancery Lane Station) and 5 min. by bus from King's Cross.)

PROOPS of KINGSTON

The only " walk-around " radio shop in Surrey

A large and varied stock of
Radio Valves, Components, Receivers, Transmitters, Test Equipment, etc.,
always available
at competitive prices.
PAY US A VISIT !

PROOPS BROS. LTD.

39, Cambridge Road, Kingston-on-Thames, Surrey **Tel. : KINgston 4614**
CLOSED—1 O'CLOCK WEDNESDAY. OPEN—ALL DAY SATURDAY
Correspondence to : 117, Charlotte Street, London, W.1.

G2AK ***This Month's Bargains*** **G2AK**

TRIPLETT 400 Micro Amp. Basic Meter Unit, sealed for 8 ranges. New, boxed, **32/6,** post free.
GERMANIUM DIODES, 2/- each or 6 for **9/-.**
METERS. 2½in. Flush mounting M.C. 100 mA., 0-10 mA., 0-30 mA., **12/6** ea. ; 2in. Flush square 0-5 mA., **10/-** ; 0-15 A. proj. thermo. 2½in., **7/6** ; 0-9 A. hot wire, **5/-** ; 0-1 mA. 2in. Flush, **20/-.**
TEST METER. 7 ranges as follows : 1.5 v., 3 v., 150 v. 6 mA., 60 mA., 5,000 ohms, 25,000 ohms 2½in Dia. scale M.C. meter. Rotary selector switch. Black bakelite case, 6 x 4½ x 4½, fitted with removable lid, also provision for internal batts. ranges can be easily extended. Bargain price **30/-,** plus 1/6 post.

SPECIAL OFFER, ARS8 SPARES. **Cabinets,** complete with base, feet and side strips, **£4/15/-** each. Pkg. and Carr., 5/-. **Set** of 14 **valves** for " D " or " LP " model receivers, **£5/10/-. Panel** escutcheons, **22/6** each. " **D** " type I.F.S., **12/6** each. **Matching Speakers** by R.C.A., fitted rubber feet and 6ft. lead, **45/-. Output Transformers to Govt. specification, 37/6 each.**

DEAF AID CRYSTAL MIKE UNITS, 12/6 each, post 9d.
CRYSTAL HAND MICROPHONES. Complete with lead and plug. High quality, very sensitive, chrome finish. List price 2 gns. Our price **25/-.** Few only.
AIR SPACED COAXIAL CABLE, 150 ohm (normal price 3/11 per ft.), 20 yd. coils only. **£1** per coil, post free.
VIBRATOR POWER UNITS. 6 v. input, 220 v. 60 mA. output. Fully smoothed and filtered, **30/-,** post free.
SPECIAL VALVE OFFER. 866A, 17/6 each, or **30/-** pair. 807's, 10/- each or 17/6 pr. 931A, **45/-.** 829B, **80/-.** 813, **70/-.**
STREAMLINED BUG KEYS. By famous manufacturer. List over £4. Our price **45/-.**
Carriage paid on all orders over £1 except where stated. Please include small amount for orders under £1.

Please print your name and address.

CHAS. H. YOUNG, G2AK

Mail orders to ***162 HOLLOWAY HEAD, BIRMINGHAM 1***
'Phone : MIDLAND 3254
All callers to ***110 DALE END, BIRMINGHAM 4***
'Phone : CENTRAL 1635

CLYNE RADIO LTD.

18, TOTTENHAM COURT ROAD, LONDON, W.1

MUSeum 5929/0095.

All goods specially selected for quality and value. Prompt service—Money-back guarantee—It will pay you to visit our new rebuilt shop premises. Situated 50 yds. only from Tottenham Court Road Tube! (Genuine.)

THE R.C. RAMBLER ALL-DRY PORTABLE KIT

Full assembly details with practical and theoretical diagrams can be supplied at 1/6, post free. This is a truly professional 6-valve superhet—all dry—for medium and long waves. A cream plastic top panel, with dial engraved in red and green, adds to the very imposing appearance of this model which is housed in an attractive cream and grey leatherette covered attache-case type cabinet, measuring only 9in. × 7in. × 5½in. Weight (less batteries) 4¼ lb. with batteries 6¼ lb. This not really has everything! Built-in frame aerial, high quality, extremely sensitive, and very adequate volume from the 5in. speaker. Valve line-up: 1T4, 1R5, 1S5, 1T4. All the required components, exactly as specified, including cabinet, can be supplied from stock at the special inclusive price of £7/7/-, plus 2/6 P. & P. (less batteries). User Ever-Ready 90v. H.T. type B126 at 9/3. Also L.T. 1.5 v. AD.35 at 1/6. N.B. When batteries are removed there is adequate space for mains unit which will shortly be made available.

ALL-PURPOSE TEST METERS. We also offer very limited supply of Ex-Naval All-purpose test meters by Everett, Edgecombe. These instruments are not brand new, but all have been serviced and guaranteed 100 per cent. condition. Complete in strong wooden case. Size 9in. × 6in. × 5½in. Leather carrying handle. 3½in. Scale—1,000 ohms per volt—Measures 0-1,000 volts AC/DC—Capacity .02 mfd.-.16 mfd.—Resistance to 10 megs.—While stocks last—Price **£7/19/6** only! Plus 2/6 packing and carriage.

HIRE PURCHASE

We are pleased to announce advantageous hire purchase facilities on any single item over £10. Your specific enquiries will receive our very prompt attention.

COIL PACKS. MANUFACTURER'S SURPLUS. Few only, iron-covered, 7 wave-band (2 medium, 5 short waves), comprising 14 coils, trimmers, wave-change switch, etc., complete with copy of manufacturer's original circuit. **50/-** only, tax paid. Completely assembled.

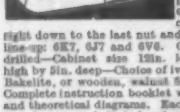
SINGLE PLAYING UNIT, by very famous manufacturer, cream, 3-speed, complete with Decca X.M.S. plug-in C. and D. heads for L.P. and Standard. **£9/9/6** only!

INTRODUCING L.T. RECTIFIERS TYPE R.K. A newly manufactured range, fully guaranteed for 12 months.

6 or 12 v. 1 a. F.W. bridge type	7/6
6 or 12 v. 1.5 a. F.W. bridge type ..	9/-
6 or 12 v. 2 a. F.W. bridge type	11/3
6 or 12 v. 4 a. F.W. bridge type	15/-
6 or 12 v. 6 a. F.W. bridge type	23/6
6 or 12 v. 10 a. F.W. bridge type....	37/6

CHARGER TRANSFORMERS. High grade wax dipped, 230/240 v. input, 6/12 v. 2 a., at **11/9** only. Also 6/12 v. 4 a., at **17/6**; 6/12 v. 6 a., at **25/-**.

THE "ECONOMY FOUR" T.R.F. KIT.



A three-valve plus metal rectifier receiver. A.C. mains 200/250 v. Medium and Long waves. We can supply all required components right down to the last nut and bolt. Valve line-up: 6K7, 6J7 and 6V6. Chassis ready drilled—Cabinet size 13in. long by 6in. high by 8in. deep—Choice of ivory or brown Bakelite, or wooden, walnut finish cabinet. Complete instruction booklet with practical and theoretical diagrams. Each component brand new and tested prior to packing. Our price **£5/10/-** complete—Remember this set is being demonstrated at our shop premises! We proudly claim that our fully illustrated instruction booklet is the most comprehensive available for this type of receiver—Booklet available at **1/6** post free—this is allowed if kit is purchased later —Please add 2/6 packing and carriage for complete kit.

D.C. TESTMETER, EX-AIR-MINISTRY TYPE E, BY AVO. Instrument size 4½in. × 3½in. × 1½in. Black Bakelite case. Meter scale length 3in. D.C. volts., 2 v., 4 v., 20 v., 40 v., 200 v., 400 v., 1,000 v., 2,000 v. D.C. current, 20 mA., 100 mA., 200 mA., 2 amp., 20 amp. Resistance scale, 0-10,000 ohms. These meters have all been reconditioned, and are guaranteed perfect. Supplied complete in leather carrying case at **£3/19/6,** plus 2/- P. & P. Limited quantity.

HEATER TRANSFORMERS. Special Manufacturers' surplus. Brand new, tropicalised by Woden. Primary 0/110 v., 220/240 v., 280/440 v. Secondary 0/6.3 v./11 v. at 3 A. (very conservatively rated), **7/6** ea. only. Also, for instrument work: Primary 0/110 v., 220/240 v., 380/440 v. Secondaries 0/10 v./20 v./30 v./60 v./240 v. at 30 mA., 6.3 v. .45 A., 6.3 v. 0.9 A. Also **7/6** ea. only. Both plus 1/6 P. & P. Limited quantities!

T/V PRE-AMPLIFIER. London frequency, manufacturer's surplus. Brand new on chassis size 4½in. × 2½in. × 1½in., incorporating valve RF42, **22/6** each. (1/6 P. & P.).

R.F. UNITS. All new condition and complete. Case size 9½in. × 7½in. × 8in.

Type 24. 20-30 Mc/s., **15/-.** Switched Tuning. **Type 25**—40-50 Mc/s., **19/6.** Switched Tuning. **RF26 at 45/-.** We also have some RF26, not new, but in perfect condition, at **35/-. Type 27**—64-85 Mc/s., **45/-.** Variable Tuning.

We have a limited supply of RF27 new condition and complete, but tuning dial damaged. Price **30/-** each only. ALL these units Post Free!!

LATEST PLESSEY 3-SPEED AUTO-CHANGER. We have just purchased a very limited quantity only of these small A.C. Mixer changers. Require only 5in. above and 2½in. below motor board. Complete with turnover crystal head, **£9/19/6** only, tax paid.

TESTMETER—EX-ARMY. Direct readings 15 v. and 5 v. D.C. 6 mA. and 60 mA. D.C. current, 500 ohm and 5,000 ohm resistance ranges. Complete in bakelite case with web carrying strap. **19/6,** plus 1/6 P. & P.

T1154 TRANSMITTER UNIT. Medium/high powered for C.W.-M.C.W. R/T. 3 ranges, 10-5.5 Mc/s., 5-3.3 Mc/s., 600-200 Kc/s. Absolutely complete; 4 valves, 2 meters, hundreds of resistors, condensers, etc., in wooden transit case. Price **29/6,** plus 7/6 carriage and packing.

TELESCOPIC AERIAL MAST. Ex-R.A.F. dinghy transmitter mast. Total length when extended, 17ft. Collapses into two sections each approx. 24in. Complete with dies and lashings, lightweight duralumin construction, diameter at thickest point, 1½in. approx. tapering to ¾in. New condition, **32/6,** plus 2/- post and packing.

METER SPECIAL! We have a limited quantity of aircraft electrical thermometers, Brand new, by Weston. 3in. moving coil meter, flush square fitting. These meters have a luminous scale graduated 40-140 degrees centigrade, but the full scale deflection is approximately 120 microamps! Price **19/6** each only, plus 1/- P. & P.

VALVES. We have a very comprehensive stock of special surplus valves at competitive prices. A stamp will bring Valve Price List.

METERS

F.S.D.	Size	Type	Filling	Price
50 microamp	D.C. 2in.	M.C.	R.P.	50/-
250 microamp	D.C. 2½in.	M.C.	F.R.	40/-
500 microamp	D.C. 2in.	M.C.	R.P.	13/6
500 microamp	D.C. 2in.	M.C.	F.R.	15/6
500 microamp	D.C. 2½in.	M.C.	F.R.	35/-
1 mA.	D.C. 2in.	M.C.	F. Sq.	17/6
1 mA.	D.C. 2in.	M.C.	F. Sq. (scale calib. 1.5 kV.)	15/-
1 mA.	D.C. 2½in.	M.C.	F.R.	22/6
1 mA.	D.C. 2½in.	M.C.	Desk Type	27/6
5 mA.	D.C. 2in.	M.C.	F. Sq.	7/6
10 mA.	D.C. 2½in.	M.C.	R.P.	9/-
10 mA.	D.C. 2½in.	M.C.	F.R.	10/-
15 mA.	D.C. 2in.	M.C.	F.R.	7/6
20 mA.	D.C. 2in.	M.C.	F.R.	7/6
50 mA.	D.C. 2in.	M.C.	F. Sq.	9/6
150 mA.	D.C. 2in.	M.C.	F. Sq.	7/6
200 mA.	D.C. 2½in.	M.C.	R.P.	10/-
500 mA.	D.C. 2in.	M.C.	R.P.	9/6
500 mA.	D.C. 2½in.	M.C.	F.R.	9/6
0.5 amp.	R.F. 2in.	Thermo	F. Sq.	4/6
1 amp.	R.F. 2½in.	Thermo	R.P.	10/-
2 amp.	R.F. 2in.	Thermo	F. Sq.	9/-
5 amp.	D.C. 2in.	M.C.	F. Sq.	13/6
6 amp.	R.F. 2½in.	Thermo	F.R.	7/6
20 amp.	D.C. 2½in.	—	R.P. (with shunt)	10/6
50-0-50 amp.	D.C. 2in.	M.C.	F. Sq.	7/6
15 volt	A.C. 2½in.	M.C.	F.R.	10/-
20 volt	D.C. 2in.	M.C.	F. Sq.	7/6
15-0-15 volt	D.C. 2½in.	M.C.	F.R.	17/6
150 volt	D.C. 2in.	M.C.	F.R.	15/-
300 volt	D.C. 2in.	M.C.	F. Sq.	8/6

R.P. = Round projection. F. Sq. = Flush square. F.R. = Flush Round.
Thermo = Thermo-couple. M.C. = Moving Coil.

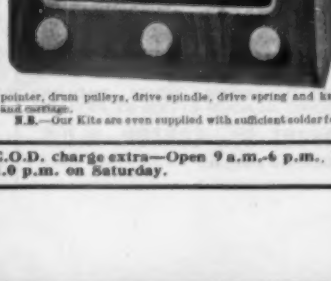
THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, I.F. Amplifier, 6Q7, 1st Audio, Detector and A.V.C., 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 volts. 4 watts output. Excellent quality, High sensitivity. Provision for gram. Attractive illuminated black, red, green and gold dial, for horizontal tuning. Four controls are: Tuning, L/M/S/Gram. Vol/on/off. Tone (variable). Chassis size: 13½in. × 6½in. × 3¼in. Dial size: 10in. × 4½in. Assembly is simplified by the use of a 3 waveband coil pack, and pre-aligned 465 Kcs. I.F. transformers—high-grade drop-through half-shrouded Mains Transformer, with voltage adjuster panel. This chassis can easily be assembled in one evening. Illustrated pamphlet with full assembly instructions, practical and theoretical wiring diagrams and itemised price list, **1/6** post free.

The main items for this receiver can be supplied separately, as under.

Drilled chassis, complete with valve-holders, A/E panel, F/U panel, tuning condenser and ready-assembled dial and drive at **39/6.** 3 waveband coil pack with gram position, **29/6** tax paid. Pair of 465 Kcs. I.F. Transformers, **9/6** pair. Half-shrouded drop-through Mains Transformer, **22/6.** The total cost of ALL items purchased separately is nearly £10, but we shall be pleased to supply all the required components right down to the last nut and bolt, at a special inclusive price of **£8/8/-,** plus 2/6 packing and postage.

A set of four small brown or cream engraved knobs to suit is available at **1/6** each knob. This chassis is a professional job in every respect, and can be seen and heard at our premises. This chassis can also be supplied, ready assembled, in very limited quantities, at **£9/19/6** plus 5/- carriage and packing.



THE "SUPERHET FOUR" KIT. Our new four-valve receiver. A.C. mains. 200/250 v. M. and Long Waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2 6B07, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size: 16½in. high × 10in. wide. Maximum depth at base, 8in., tapering to 2½in. at top. Sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at **1/6,** post free. Our price for complete kit, **£8/9/6!!!** Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and back, drilled chassis and bracket, waverchange switch, dial, pointer, drum pulleys, drive spindle, drive spring and knobs, at **45/-,** plus 2/6 packing and carriage.

N.B.—Our Kits are even supplied with sufficient solder for the job!

Please add postage under £1. C.O.D. or Cash with order. C.O.D. charge extra—Open 9 a.m.-6 p.m., Monday to Friday. Sorry but we close at 1.0 p.m. on Saturday.

GEE RADIO

VALVE TESTER TYPE 4. 200-230 v. A.C. Input. Ex-Govt., in good condition, with descriptive book containing circuit diagram of instrument and how to test valves from 1.4 v. to 40 v. With valve-holders for Brit., 4, 5, 7 pin and Octal, U.S., 5 and 7 pin, I/Octal, side contact, large Brit., 4 and 9 pin, Acorn and diode. Housed in substantial wooden case. Price £7/19/6, carriage 10/- extra.

WESTON ALL-PURPOSE A.C./D.C. TEST METER MODEL E.665. New and unused, complete with leads and batteries, £8 only, p.p. 3/6; Also:

WESTON BATTERY OSCILLATOR MODEL E.692. TYPE 2. Also new and unused. Coverage 100 kc/s.-26 Mc/s. Audio output approx. 400 c/s. Available at the ridiculously low price of only £5/19/6, p.p 4/6. (Oscillator complete with instruction booklet.)

BATTERIES H.T. AND L.T. Heavy duty layer type. 150v. tapped at 87v. H.T. L.T. 4½v. Perfect condition. Size 9½in. x 4½in. x 4½in., 4/6 each, p.p. 2/- on each battery. Also 90v./1½v. Ditto as previously advertised, 4/6, p.p. 1/8 each.

AMERICAN DYNAMOTOR, TYPE PE.103A. Heavy duty power supply. Input 6 v. at 21 amps. or 12 v. at 11 amps. Output 500 v. at .16 amps. Rating continuous. Made by Crosley Corp., Ohio. New and unused, complete with connection cable and mounting rack. Price quoted against enquiries.

42in. EXPONENTIAL HORNS. 1⅝in. fitting. These horns have a 28in. square flare, weigh approx. 25 lb., and measure 44in. from top to bottom, £2/19/6, carriage 7/6.

VITAVOX PRESSURE UNITS. Heavy duty P.M., 20 watts. To fit the above horns, £4/9/6, carriage 5/-.

ROTARY CONVERTERS. 230 v. D.C. to 230 v. A.C. at 110 watts. Complete with voltage controlling sliding resistor, £7/10/-, carriage 10/-.

ROTARY CONVERTERS. 12 v. D.C. input 230 v. A.C. output at 100 watts. Brand new, £4/17/6. Ditto, 24 v., same price, carriage 7/6.

R.1155 COMMUNICATION RECEIVERS. Individually tested and despatched in good working order. Cases slightly soiled, £8/19/6, carriage 10/-.

R.1132A RECEIVERS. In good condition, £2/19/6, carriage 10/-

POWER UNIT, TYPE 3. Made for use with the R.1132A, this is a standard rack mounting job to match the receiver and is for 200/250 v. 50 cycle mains with outputs of 250v. D.C., 100 mA., L.T. 6.3v. 4 amps. Price £3/10/-, carriage 5/-.

RECEIVER, TYPE 109. An 8-valve ex-Army receiver, in good condition, complete with built-in power supply, loudspeaker and four spare valves. Frequency range on 2 bands, 1.8-3.9 Mc/s., 3.9-8.5 Mc/s. 15-160 metres continuous and covers some of the shipping band. This unit can be operated from a 6 v. battery. Price £3/10/-, carriage 5/-.

HOOVER 1/6TH H.P. MOTORS. 400/440 v. Three phase. Standard shaft. 1,425 r.p.m. Brand new in original maker's cartons, £3/10/-, carriage 5/-.

VARIABLE VOLTAGE REGULATOR TRANSFORMERS. Input 230 v. A.C. at 21 amps. Output 57.5 in 16 equal steps to 230 v. at 21 amps. Ex-Govt., in perfect condition, £15, carriage 5/-.

TRANSFORMERS. Input volts 0-10, 20, 30, 50, 100, 150, 200 and 240 v. Output 2000-0-2000 at 450 mA., £3/10/-, carriage 10/-.

TRANSFORMERS. Heavy duty, suitable for welding. 230 v. Prim. 50 cycles. L.T. variable, 11½ v.-13½ v. 60-70 amps., £3/19/6, p.p. 5/-.

TRANSFORMERS. 12 v. Car Radio, ex-Philco, 300 v. H.T. 90 mA. Brand new and unused, only 12/6, p.p. 1/6.

TRANSFORMERS. Auto., 110 or 230 v., in or out, for stepping up or down. 750 watt, switched and fused. By B.T.H., £4/15/-, carr. 5/-.

HALF MILE OF TWIN DON "8" TELEPHONE WIRE. Brand new. On wooden drums, £3/12/6 per drum, carriage 8/6.

SIEMENS HIGH-SPEED RELAYS. Twin 1,000 ohm. coils, as new, 15/- each, p.p. 1/-.

PHOTO-ELECTRIC MULTIPLIER CELLS, TYPE 931A, £2/10/- p.p. 1/-.

813 CERAMIC VALVE HOLDERS, brand new, 9/6, p.p. 6d. Ditto 832 valve holders, used but in good condition, 5/-, p.p. 6d.

TELESCOPIC AERIALS. Chromium plated. Min. length 12in., max. length 48in. Ideal for Car Radios, 8/6 each, p.p. 9d.

METERS.

0-1 mA., 2½in. F/Mounting, new and boxed	21/-, p.p. 1/-
0-1 mA., 2in., R.F. Round	5/9, p.p. 1/-
0-30 mA., 2½in. F/Mounting	12/6, p.p. 1/-
0-30 mA. 2in. Round, new and boxed	7/6, p.p. 1/-
0-200 mA., 2½in. F/Mounting	12/6, p.p. 1/-
0-10 amps. D.C., 3½in. F/Mounting	15/-, p.p. 1/6

REFLEXED SOUND PROJECTORS—HAILING LOUD SPEAKERS. 10 watts output. Size 14½in. round flare, length 12in. Perfect condition, £3/9/6, carriage 5/-.

PARMEKO OUTPUT TRANSFORMERS. 25 Watts. for 6L6 valves. To match, 3, 8 and 15 ohms. New and unused, 29/6, p.p. 3/6.

CAMERA CONTROL UNIT, TYPE 35. 24 v., 25/-, p.p. 2/6.

MANY OTHER LINES IN STOCK; YOUR ENQUIRY INVITED; QUOTATIONS GLADLY GIVEN BY RETURN.

15 LITTLE NEWPORT ST., LONDON, W.C.2

GERrard 6794/1453.

MIDLAND INSTRUMENT CO.

P.M. SPEAKERS, all brand new, less transformer, Elac 6½in. dia., 13/6, post 1/6. Goodmans 6½in. dia. wafer type, 10/-, post 1/3. Elac 3½in. square front, 10/-, post 1/-. Plessey 3in. dia., 8/6, post 9d.

SANGAMO WESTON AIRCRAFT INSTRUMENTS, each contains 2 separate and easily removable moving coil microampere meters, 1½in. movement edgewise pointer scale, less the 2 neon lamps usually fitted, 7/6, post 1/-.

BECK PRISMATIC PERISCOPES, 6x magnification, adjustable eyepiece at right angles, length 17in., extends to 23in. Detachable handgrip, perfect condition, in leather carrying case, bargain, 35/-, post 1/6.

VENNER TIME DELAY SWITCHES, 24-v. operation, consists of a high grade clockwork movement, with external press button wind, 2 electro magnets with 5-pole cam operated contacts, in smart metal case size 3½in. × 2½in. × 2½in., fitted 4-way terminal block, new boxed, fraction of original cost, 7/6, post 1/3.

HOOVER BLOWER MOTORS, dual voltage, with terminations for 12 or 24-v. D.C., otherwise suitable for 20 or 40-v. A.C., length 5½in., dia. 3in., fan casing 4½in. dia. inlet and outlet ports 1½in. dia., the most useful and versatile blower offered, suitable for car heaters, air conditioning and cooling purposes, new, unused, 25/-, post 1/6.

ELECTROLYTIC CONDENSERS, 32-mfd. 450-v. D.C., by Zenith, Micamold etc., new and guaranteed, cartons of 25 condensers, 20/-, post paid.

ANTI-VIBRATION MOUNTINGS, floats on 16 tension springs, 10lb. stress, 4 equals 40 lbs., brand new, sample 6d., post paid; cartons of 48 mountings 7/6, post 2/4, reduction for quantity.

CHARGING KITS, consists of a G.E.C. 12-v. 1½-amp. selenium full-wave rectifier, and a Douglas 200/250 v. transformer, specially wound for this rectifier, with requisite voltages to charge a 2, 6 or 12-v. battery at 1½ amps., 2 brand new components, with circuit diagram and instructions, 25/-, post 1/6.

PROJECTION UNITS, consists of an optical mount, fitted with a bloomed f/2.2 Achromatic lens, 3½in. focal length, at one end, also a convex/concave ground glass at the other, attached to an enclosed lamphouse, fitted with a 24 v. 15-watt lamp, and polished reflector, fraction of original cost, 10/-, post 1/-.

ARROW SWITCHES, 250 v. 25 amp., rotary 4-position, 3-heat and off series parallel, panel mounting, complete with pointer knob, new boxed, worth 18/-, our price 2/6, post 1/3; 24/- doz., carriage 5/-.

AMPLIFIERS TYPE A-1371, consists of a VR-56 valve, type P-2000 relay, 400-ohm 6-pole, 4-make, 2-break, 2 transformers, potentiometer, various resistors and condensers, cannon plugs, in metal case size 5in. × 5in. × 5in., perfect condition, 10/-, post 1/10.

PERMANOID (P.V.C.) covered connecting wire, single 1/022 tinned copper, .030 insulant, brand new 250-yd. coils, in red, yellow, green, brown or purple, 12/6 coil, post 2/-. 5 coils, one of each colour, 50/-, carriage 6/-. Samples on request.

WIRE STRIPPERS, strips the insulation from flexes and cables up to ¼in. dia., micrometer adjustment, brand new boxed, toolshop price 15/-, our price 5/-, post 6d., 2 for 10/-, post paid.

U.S. RELAYS, Leach pattern, by G.E., 200-ohm, 2-pole changeover, 1/6, post 4d.; 15/- doz., post 1/8. Ditto, 3-pole changeover, 1/9, post 4d.; 18/- doz., post 2/-. Taken from new equipment, reduction for quantity.

VARIABLE RHEOSTATS, wire-wound on ceramic, 50-ohms at 1-amp., laminated wiper arm, bakelite knob control, in diecast cases size 3½in. × 4½in. × 2½in., fitted on/off toggle switch and 2 cannon plugs, new, boxed, 7/6, post 1/6.

V.H.F. SWITCHES, an ideal switch for use when one aerial feeds two T.V. etc., sets 4-position switch gives the following conditions, both off, No. 1 on only, No. 2 on only, both on, in base mounting metal cases size 4in. × 2½in. × 1¼in., fitted 3 Pye sockets, new, unused, worth 20/-, our price 3/6, post 1/-.

Many other bargains; send 2d. with S.A.E. for current lists.

MIDLAND INSTRUMENT CO. MOORPOOL CIRCLE, BIRMINGHAM, 17

Tel.: HAR 1308

1 KW TELEGRAPH TRANSMITTERS. Two HF 300's output. Operation 3.5 mc. to 16 mc.

BC610 TRANSMITTERS with speech amplifier, aerial tuning unit, etc. Brand new.

RCA TRANSMITTERS. Type **ET-4336.** Complete with original speech amplifier, crystal multiplier and VFO units. Unused and reconditioned. Can be supplied with very large quantity of spares.

RCA TRANSMITTERS. Type **ET-4332** modified by R.A.F. for use on crystal or master oscillator. Complete with speech amplifier.

MAGENTO 10 LINE U.C. TELEPHONE SWITCHBOARDS (complete).

SCR510's, complete with Power Pack and telescopic aerial.

SCR536 (BC611) in excellent condition.

A.R.88D's, A.R. 88LF's, A.R.77's, S27's, HRO, R.109 and others.

METAL RECTIFIERS. Type 1B, D.C. output 10 amps at 22v. input 220/250v., 50 c/s.

All above items in excellent working condition.
Working demonstration upon request.

SPARES A large selection available for SCR399 (BC610), ET4336, SCR610, EE8 Telephones, and Teleprinters type 7B.

TX VALVES 805, 807, 813, 861, 866A, 100TH, 250TH, and many others.

Large stock of Tx condensers, crystals and other components. Alignment and repair of communication receivers and all other short-wave equipment undertaken.

P.C.A. RADIO

New Address, Offices and Works:

BEAVOR LANE, HAMMERSMITH, LONDON, W.6

Telephone: RIV 8005

Henry's RADIO COMPONENTS ELECTRONIC & TELEPHONE EQUIPMENT (RADIO LTD.)

5 Harrow Road, Paddington, W.2

PADdington 1008/9 and 0401

OPEN MONDAY to Sat. 9—6. THURS. 1 o'clock.

SEND STAMPS FOR NEW 1954 28-PAGE CATALOGUE

★ TAPE-DECK AMPLIFIER AND POWER UNIT ★

This unit is specially designed for the "Truvox" unit and we believe this quality amplifier lifts tape recording from the novelty, into the quality class.

AMPLIFIER SPECIFICATION :

★ 2-5BR7 2—6V6GT, 1—6J5, 1—6U5G ★ Variable selective negative feed back circuits ★ Variable tone control ★ Magic eye level indicator ★ Four watts undistorted output ★ Amplifier complete with valves, £13/5/-.
Chassis size 10in. x 6in. x 2½in.

POWER UNIT (AC200/250 volts)
Chassis size 9in. x 5in. x 2½in., complete with 5Z4..... £4 15 0
Amplifier and Power Unit complete..... £16 16 0

CALL FOR DEMONSTRATION OR SEND FOR FULL DETAILS

SPECIAL OFFER !

Our **TAPE-DECK AMPLIFIER AND POWER UNIT** (List £16/16/-) as above and **TRUVOX TAPE-DECK MARK III** (List £23/2/-).

£36 . 0 . 0

RADIO-GRAM CHASSIS

3 Wave-band Superhet. Med., long and short.
5 Latest Type MULLARD Valves.
4 Position Switching. Gram., med., long and short.
Provision for Extension Speaker. A.C. Mains. 110/250 volts.
Chassis 11in. x 7in. x 2½in. Scale 6in. Square. Or Chassis 13½in. x 6½in. x 2½in. Dial 10½ x 5½in. PRICE £10/5/-.
BRAND NEW AND GUARANTEED, CARR., PACKING AND INS. 10/-.

62A INDICATOR UNIT

Complete with VCR97 or 517C, 12—EF50, 4—SP61, 3—EA50, 2—EB34.
Built on double-deck chassis.
Absolute new condition.
99/6. Carr. 7/6.
Or less Tube, 69/6. Carr. 7/6.

PYE 45 MC/S. STRIP, TYPE 3383 UNITS

Size 15in. x 9in. x 2in. Complete with 45 Mc/s. Pye Strip, 12 valves, 10 EF50, EB34 and EA50, volume controls and hosts of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price £5. Carriage paid.

VOLTMETERS				
6 v.	M.C.	2½in.	Projection	10/-
15 v. (50 c.)	M.I.	2½in.	Flush	10/-
20 v.	M.C.	2in.	Square	7/6
150 v.	M.C.	2½in.	Flush	10/-
300 v. (50 c.)	A.C.	Projection 6in. Dial		50/-
250 mA.	T/C	2in.	Square	6/-
AMP-METERS				
1 A.	M.C.	2½in.	Projection	10/-
3 A.	T/C	2in.	Square	6/-
6 A.	T/C	2½in.	Flush	7/6
15 A.	M.I. (50 c/s)		Projection	21/-
20 A.	M.I. (50 c/s)	2½in.	Flush Mtg.	12/6
30 A.	M.C.	2in.	Square	7/6
MILLIAMMETERS				
500 uA.	M.C.	2in.	Round	15/-
1 mA.	M.C.	2in.	Square	17/6
1 mA.	M.C.	2½in.	Flush	22/6
1 mA.	M.C.	2½in.	Desk Type	25/-
5 mA.	M.C.	2in.	Square	7/6
10 mA.	M.C.	2½in.	Flush	10/-
30 mA.	M.C.	2in.	Round	7/6
30 mA.	M.C.	2½in.	Flush	10/-
50 mA.	M.C.	2in.	Square	7/6
150 mA.	M.C.	2in.	Square	7/6
200 mA.	M.C.	2½in.	Flush	10/-
200 mA.	M.C.	2½in.	Round	10/-
500 mA.	M.C.	2½in.	Flush	10/-
G.E.C.	1 mA.	Meter	Rect.	10/-

M.C. = Moving Coil. M.I. = Moving Iron.
T.C. = Thermo-Coupled.
All Meters are Brand New and in original cartons.

No. 38 "WALKIE TALKIE" TRANSRECEIVER, complete with Throat Mike, phones. Junction Box and Aerial Rods in canvas bag. Freq. range 7.4 to 9 Mc/s. Range approx. 5 miles. All units are as new and tested before despatch. £4/10/-.

"426" CONTROL UNIT

Containing 4-EF50, 2-SP61, 2-EA50, 1-EB34, 2-single-gang .0005 tuning condensers. W/W. volume/controls, switches, condensers and resistors. Size 12in. x 9in. x 5in. New condition, 35/-, carr. 3/-.

BOWTHORPE CONTINUITY METER

Dual scale 0-500 ohms and 100-200,000 ohms moving coil operated from 4½-volt internal battery. Size 6 in. x 3 in. x 4 in.
Original price. £8 10 0
Our price, brand new, £3 5 0

T.C.C. ·1 mfd., 5/7,000 v. wkg., type CP58Q0, bakelite case. 7/6 each

INDICATOR UNIT TYPE 182A

Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-metal screen, 3 EF50, 4 SP61 and 1 5U4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Suitable either for basis of television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay) in original packing cases at 67/6. Plus 7/6 carr.

ROTARY POWER UNIT TYPE 104

Input 12 v. Output 230 volts 65 mA. and 6.3 volts 2.5 amps. Fully filtered and smoothed and noise suppressed. Ideal for car radio, etc. BRAND NEW ONLY 15/- (postage, etc., 2/6). ALSO 24 v. type 15/-.

G.E.C. RECORDING TAPE

600ft. Reels 10/-
1,200ft. Reels 17/6
BUY NOW—UNREPEATABLE BARGAIN.

MORSE PRACTICE KIT

Complete with buzzer, morse tapper and battery compartment on baseboard. 6/-, post paid.

SOLDER

1lb. Reels Du-Bois 60/40, 7/6.

500 KC/S CRYSTALS

Standard 2-pin. Ex new units, guaranteed. 15/- each.

EF50 (VR91A)

The selected EF50, Red Sylvania, original boxes 10/- each, 90/- for ten.

RECORD CHANGERS

COLLARO RC5/631. Latest model 3-speed. Brand new maker's carton, cream finish. £10/10/-, carr. free.
Latest model 3-speed, by very famous manufacturer, plays mixed records. £10/10/-, carr. free.

BIB WIRE STRIPPER AND CUTTER

Strips insulation without "nicking" wire.
Cuts wire without leaving rough edges.
Splits extruded flex.
A product of "Multicore" 3/6 each, p.p. 9d.

R.F. OSCILLATOR UNIT

6—18 kV., including rectifier winding. 25/-.

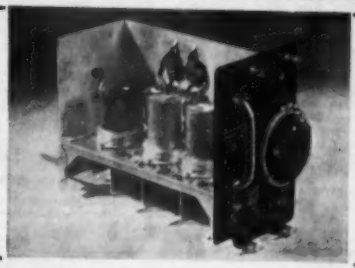
AMERICAN 12 v. DYNAMOTOR

Output 250 volts, 60 mA. Weight 5 lb. Suitable for Car Radio or Electric Razors. 22/6.

R.F. UNITS

Type 24
20-30 Mc/s.
Switched Tuning.
With 3-SP61
15/- EACH
BRAND NEW.

Type 25
40-50 Mc/s.
Switched Tuning.
With 3-SP61.
19/6 EACH
BRAND NEW.



R.F. UNITS

Type 26
50-65 Mc/s.
Variable Tuning.
2—VR136, 1—VR137
45/- EACH
BRAND NEW.

NEW, BUT SLIGHTLY SOILED

R.F.24's 12/6
RF.25's 15/-
R.F.26's 35/-

T.V. PRE-AMPLIFIER FOR LONDON AND BIRMINGHAM. Complete with 6AM6. Ready to plug into your set, 27/6. P.P. 2/6.

CRYSTAL MICROPHONE INSERTS

8/6 POST FREE

8/6 POST FREE

Ideal for tape recording and amplifiers. No matching transformer required.

CATHODE RAY TUBES

VCR138A. 2½in. C/B. Tube. Brand new in original cartons (carr. free) £1 15 0
VCR97. Guaranteed full T/V picture (carr. 2/-) £2 0 0
VCR517C. Guaranteed full T/V picture.. £1 15 0
MU-METAL SCREENS for VCR97 or 517. P.P. 1/6..... 10 0
6in. ENLARGER for VCR97 or 517. P.P. 1/6..... 17 6

PHOTO CELLS CMG25. Brand new, 25/-.

WANTED

723A/B, 813, 931A and Crystals. Top prices. Any quantity.

PLEASE ADD POSTAGE. ARTICLES UP TO 10/-, 1/-. £1, 1/6. £2, 2/-.

HAVE YOU A TYPE 18, 21 OR 22 TRANS./RECEIVER? if so buy these brand-new and boxed ARP12 Valves at 4 for £1, or 5/6 each—while they last.
TYPE 6C OSCILLOSCOPE UNIT with VCR 138/ECR35 3½ inch tube. Valves—2-EF50, 2-EB34. Conversion circuit to standard 'scope supplied. Price 58/6.
LABORATORY TEST EQUIPMENT. For aligning and checking Trans./Receivers covering 150 to 234 Mc/s. comprising:
Type BC906. Frequency Dip Grid Meter. 145-235 Mc/s.
Type 1-196-3. Signal Generator. 150-234 Mc/s.
Type BC1066-R. Radio Receiver. 150-234 Mc/s. Price £12 the set. Carriage extra. Just right for aligning and checking the new T.V. and F.M. bands. Also checks Aerial Resonance.
VALVES. Lists supplied.
CYLDON 5 CHANNEL PRE-TUNER. Gives 26 D.B. gain. Fit one of these to your T.V. for better pictures. I.F. Output 9.5-14 Mc/s, 15.5-22 Mc/s. With valves. EF80, ECC81, 52/6. Less valves, 15/-.
NEW 0-100 MICRO-AMP. METERS, 4½ inch. Round flush mounting. Made by Ernest Turners. £3/12/6.
MAINS TRANSFORMERS. Input 200/240 v. Output 350-0-350 at 250-0-250 volt 80 mA., and 4 and 6.3 v. 4 a. and 4 and 5 v. 2 a. Price 21/6. Input 200/240 v. Output tapped 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 volts, 2 amp., 21/6. Output 17-11-5 volts 5 amp., 22/6. Output 17-11-5 volts 1½ amp., 16/6. 6.3 v. 2½a., 9/6. All with one year's guarantee.
D.P.D.T. RELAYS. Operate at 200/300 volts D.C., 8/6. We can supply any type of voltage and contacts at varying prices.
NEW SELENIUM RECTIFIERS. F.W. 12/6 volt 3 amps., 14/6; 4 amp., 22/6; 6 amp., 30/-; 1 amp., 8/6; 12 v. 100 mA., 3/-; 24 v. 2 amp., 30/-; H.W., 250 v. 100 mA., 9/-; 250 v. 275 mA., 17/6.
GERMANIUM CRYSTAL DIODES, 3/9.
M/C MICROPHONES with matched Trans., 15/6.
FLS FILTER UNITS, 8/6. Same as FLS but less switch.
TRI196 TRANSMITTER SECTION. New and complete but less valves. 4.6-6.8 Mc/s. Easily converted, 15/-. With valves, £2.
L.R. ARMY HEADPHONES, 9/6.
TIME DELAY RELAYS. We specialise in units giving varying time constants. **Please send us your requirements or problems.**
FISHING ROD AERIALS. Set 3—12ft., 7/6.
RUBBER MOUNTING BASES, 3/6.
P.O. VEEDER COUNTERS 0-9999, 24/50 volts D.C., 15/6.
19in. x 10½in. x 16in. RACK MOUNTING STEEL CASES, with ⅛in. ali. panels and two handles, 16/6.

All Carriage paid in the U.K. from Dept. W.W.,

The RADIO & ELECTRICAL MART
253B PORTOBELLO ROAD, LONDON, W.11.
Phone: PARK 6026

SPECIAL OFFER—"AVO" MINORS, Universal A.C./D.C. Reconditioned and in perfect order, £5/15/-.
"AVO" MINORS, D.C. "E" Type, also reconditioned and perfect order, £3/5/-.
ADVANCE SIGNAL GENERATORS. Type E.1. £21.
MEGGER SAFETY OHMMETERS. Perfect. £4/10/-.
H.R.O. SENIOR RECEIVERS. With A.C. P.P., 5 coils, £33/10/-.
D.S.T. 100 RECEIVERS, as new. Coverage is 7 bands from 30 Mc/s. to 50 Kc/s., £24/10/- each.
HAMMERLUND H.Q.129. Mint condition, rack mtg., £42.
HALLICRAFTERS SX28, S27, S41, S38, etc. Perfect cond.
AR88LF, AR88D, CR100, from stock. **R1155 RECEIVERS,** new.
CANADIAN R.103 RECEIVERS, as new, modified for A.C. working, £18/10/-.
LELAND R.F. WOBBULATOR, perfect order, £12/12/-.
A.C./D.C. MOTORS, suitable for sewing machines, 47/6 each.
A.C./D.C. 12 v.-15 v. MOTORS, long spindle for models, 15/- each.
NEW M/C MICROPHONES, hand type, with 12 yds. heavy duty screened cable, £3/15/- each.
B.C.221 FREQUENCY METER, from stock. Many items of American equipment available.
TEST EQUIPMENT. We hold a comprehensive stock. Multi-range meters at 1,000 and 20,000 o.p.v., valve testers, signal genes.
UNISELECTORS. 4-bank, double wiper, 24/- each.
10,000 POTENTIOMETERS, large size, by Colvern, enclosed 8/6 each. 100k, 15w, 9/6 each.
MAINS TRANSFORMER. 350-0-350 v. Ellison at 120 mA., 6.3 v., 5 a., C.T. 5 v. 3 a., 37/6. Full range of all types of Ellison products in stock.
COSSOR DOUBLE BEAM OSCILLOSCOPE, perfect, £33.
EDDYSTONE 640 RECEIVER. Perfect, at £22/10/-.
6 VOLT (3 at 2 v.) BOXED ACCUMULATORS, 18/-.
.1 uF350 v. METAL CASED TUBULARS, U.S.A., at 4/6 doz. (minimum 2 doz.).
H.R.O. COILS. .46-.96 Mc/s., etc., at £2/5/- per coil.
LARGE STOCKS OF MOTORS. A.C./D.C. and A.C., 1/16, 1/12, ¼, ½ h.p.

Your post enquiries welcomed. S.A.E. for reply, please. Orders, C.W.O. or Pro-forma Invoice, no C.O.D. Prices quoted do not include carriage and packing.

All types of equipment purchased. Top prices paid.

SERVICE RADIO SPARES
4, LISLE STREET, LONDON, W.C.2
Telephone: GERrard 1734.

CABLES AND FLEXES
CHEAPER IN ODD LENGTH COILS
No coil under 20 yds. All Prices per 100 yd. lot.
Everything tested and guaranteed.
(100 yd. Coils can be supplied-add 1/6 in £ to prices)

TWIN FLAT	1/044	3/029	W/E	W/E	7/044	W/E
			Do.	7/029		Do.
RUBBER	39/-	49/-	59/-	101/-	156/-	196/-
PLASTIC	36/-	49/-	57/-	99/-	135/-	186/-
Single V.I.R.	17/-	21/-	—	34/-	66/-	—
Single Plastic	13/-	22/-	—	36/-	72/-	—

CIRCULAR	Twin 14/36	23/36	40/36	23/36	3 Core 40/36
RUBBER	54/-	61/-	76/-	77/-	100/-
PLASTIC	41/-	51/-	76/-	82/-	89/-
Fwd./Braided	35/-	42/-	53/-	58/-	66/-

FLEX. Plastic twin twisted or flat, 13/9. Maroon flex, 24/-.
(In 10/20 yd. coils 20/-) In 100 yd. coils 27/6.
100 yd. Coils Transparent Plastic, T.T. or flat, 15/-; **Earth Wire** 7/029 tinned, 7/6; per 100 foot lot. Less than 100 yd. lot of anything supplied just add 5%. Send for lists, every type ever made is available. Add part carriage to small orders please.
British Distributing (W.W.), 501 Green Lanes, London, N.8. MOU. 0055/6.

ELECTRADIX

POWER FACTOR METERS. Record Cirscale, 6in. portable in polished wood case, 230 volts 50 cycles S.Ph., £40. 415 volts 3 phase, unbalanced load, £42. Delivery ex stock.
AMMETERS, VOLTMETERS, etc. 2½in., flush or projecting panel, new, bakelite case moving iron, spring controlled for a.c./d.c., zero adjuster, all readings up to 30 amps. and all readings up to 30 volts, 17/6 each. Moving Coil d.c. and Rectifier Meters quoted for to specification.
FREQUENCY METERS. 6in. Switchboard type. Ironclad 230 volts 40 to 60 cycles, brand new and guaranteed, £15 each.
KLYSTRONS type 723 A/B, as new and guaranteed.

Leslie Dixon & Co.
Dept. A, 214 Queenstown Road, London, S.W.8
Telephone: MACaulay 2159

P.M. LOUDSPEAKERS. Elac 6½in., 15/-, post 1/-. Elac 3½in. square, 12/6, post 9d. Goodmans 6½in., 15/-, post 1/-. Plessey 3in., 10/6, post 9d.
MOTOR GENERATORS. D.C. Ref. 10k/1859. Input 11 v. output 200 v. and 24 v., any of these values can be reversed, 50 mA. output, suitable car radios, can also be used as trickle from D.C. source, 10/-, post 2/-.
CAR BATTERY CHARGING SETS. Has G.E.C. 1.25 amp. selenium rectifier, matched transformer, tapped for 12, 6, or 4 volts, all mounted on wood block ready for use, extra diagram enclosed, price 30/-, post 2/-. The above are also suitable for electric trains.
U.S.A. THROAT MIKES, 1/6 each, post 3d.; 15/- dozen, post 1/3.
TEST PRODS, with 2ft. flex, brass prods, 2/6, post 4d.; 24/- dozen, post 9d.
PROJECTION UNITS. Contains 40 mm. Achromatic lens, F.L. 3.5 mirror, dark lens with hair line, perfect, taken from new bombsights, 10/-, post 1/-.
RELAYS. P.O. Type 2000, coil 2,000 ohms, 4/6 each, many others, post 6d.
Send off for new list.

L. C. NORTHALL
19 HOLLY ROAD, QUINTON, BIRMINGHAM, 32.
Phone: WOO 3166.
Showrooms: 389 BEARWOOD ROAD, SMETHWICK.
Phone: BEA 1548.

RELAYS, P.O. TYPE 3000 KEYSWITCHES, ALL TYPES

Send us details of your requirements, we shall be pleased to quote.

VOLTAGE REGULATORS. Input 230 volts A.C. 21 amps., output 57.5 to 228 volts in 16 steps. With current limiting Reactor, £19.
VARIAC TRANSFORMERS. Type 80 CO. Input 200/240 v. Output 220 v. 7.5 amps. £6/10/- each.
HIGH STABILITY RESISTORS. 1%, 2%, 5% and wire wound vitreous available ex-stock. Best makes, low prices.
PYREX AERIAL INSULATORS. Glass dome type with threaded rod and terminals each end, 2½in. diam, with fixing flange. Ideal for all aerials and in particular cabin walls or panels, etc., 2/- each. Glass ribbed type, 7in. long., 3/6 each. Post 6d.

For other items available see the advertisement of our associated company WILCO ELECTRONICS.

L. WILKINSON, 19, Lansdowne Road, Croydon
Telephone: CRO 0829

T.V. REPLACEMENTS

R.F.; E.H.T. GENERATOR 6-9 KV.
This is a made-up unit working on the Blocking Oscillator/Overwound Amplifyin stage principle. It is of moderate power consumption (6.3 at .9 amp. L.T., and approx. 60 mA H.T.) and contains three of the latest B.V.A. glass valves. Output obtainable ranges from 6 to 9 K.V. with normal H.T. rail input, but somewhat higher outputs can be obtained with higher H.T. supply. Dimensions of unit 6½in. × 4½in. **Price 57/6,** *plus 3/6 carr., pkg. & ins.*

"SUPERIOR 15"
Up-to-the-minute 15in. C.R.T. Televisor which can be built for approx. £30 including "COSSOR" 85K tube. All latest features, like Flyback E.H.T., Diode Damped Interlace. Superhet circuit sound and vision, etc. Data Envelope, giving easy to follow circuits and Notes, 5/-, post free.

Have you received a copy of our General Trade Catalogue. Also our Bulletin, issued each month.

TRADE ONLY SUPPLIED
V.E.S. WHOLESALE SERVICES LTD.
11 GUNNERSBURY LANE, ACTON W.3. *Telephone: ACOrn 5027*

LASKY'S RADIO

12 VOLT-4 WATT MOBILE AMPLIFIERS. BRAND NEW AND UNUSED.

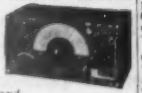
In Original Cartons. KT.61 output. Complete with power unit and synchronous vibrator (Wearite type QFA/12), and all valves. Fitted with rubber covered heavy duty battery lead.

By famous manufacturer, in handsome metal cabinet, grey crackle finish. Size: 10½in. × 6½in. × 8in. Output impedance 3 ohms. With the addition of a suitable loudspeaker, this is ready for operation. Finest quality components throughout. Robustly constructed for rough handling. Complete with carbon hand-microphone with screened lead.

LASKY'S PRICE COMPLETE .. **£7.19.6**
OR LESS MICROPHONE .. **£6.19.6**
Carr. 5/- per unit extra.

R.1155 RECEIVERS

BRAND NEW—AERIAL TESTED BEFORE DESPATCH



These well-known ex-Air Ministry Receivers need no further introduction. Supplied complete with 10 valves and full circuit data.

LASKY'S PRICE **£11.19.6**
USED MODELS **£7.19.6**
Carriage 12/6 per unit extra, including 10/- returnable on packing case.

FULLY ASSEMBLED POWER PACK AND OUTPUT STAGE

for R1155 Receiver. For use on 200-250 volts, A.C. mains.
LASKY'S PRICE **79/6**. Carriage 5/- extra.
The above power pack fitted with 6½in. speaker.
LASKY'S PRICE **£5.5/-**.
Carriage 5/- extra.

PORTABLE RECORD PLAYERS

Containing a new Plessey single speed automatic record changer (78 r.p.m.). Magnetic pick-up and 2-valve amplifier, with metal rectifier. For use on 200-250 v. A.C. mains. Amplifier uses EF.36 and EL.32 giving 2-watts output, tone and volume controls, 5in. speaker. In rexine-covered cabinet, size: 17 × 17 × 8in. With carrying handle. Though store soiled, these players are new and every one is fully tested before despatch. LIMITED QUANTITY.
LASKY'S PRICE **£10.19.6**
Carriage 10/6 extra.
The cabinet available separately, soiled. PRICE **25/-**. Carriage 5/- extra.

HEARING AIDS

In metal case, 5½ × 4½ × 1in. Self-contained with batteries and 3 sub-miniature valves. Volume control and on/off switch, internal crystal microphone. Perfect working order. Soiled.
LASKY'S PRICE **49/6**. Postage 2/6.

MINIATURE SINGLE HEADPHONE

On spring steel headband. Diam. 1¼in. Resistance 200 ohms. With 30in. twin cord
PRICE **17/6**.

TANNOY PRESSURE UNITS

10 watts, 7.5 ohms amp. PRICE **50/6**. Carriage 4/6 extra.

1-lb. REELS OF RESIN CORED SOLDER. LASKY'S PRICE 7/6.

AERIAL ROD SECTIONS

Steel, heavily copper plated. 18in. long, ¼in. diameter. Any number may be fitted together.
PRICE **2/6** per doz. POST FREE.

MANUFACTURERS' SURPLUS T.V. COMPONENTS

Wide Angle Scanning Coils. Low Imp. line and frame ..... pair **19/6**
Scanning Coils. 35 mm. Low imp. line and frame **12/6**
Frame output transformer. Standard Focus Coil. 35 mm. electro magnetic Line or Frame B.O. transformer. Auto **4/6**
Wide Angle Frame B.O. trans. **10/6**
P.M. Focus Magnets. With vernier, 35 mm.
Tetrode **15/-**
Triode **17/6**
Wide Angle P.M. Focus Unit. For all 30 mm. tubes. With vernier and picture shift, Ferroxdure **25/-**

PLESSEY

Scan coils per pair **95/-**
Width Control **6/6**
P.M. Focus magnet **12/6**

CAR RADIO SPECIAL—PARTLY ASSEMBLED CAR RADIOS

Small size case, 12 × 6 × 6in. Will fit most cars. For either 6 or 12 volts, depending on vibrator. Chassis supplied with 5 octal valve holders, medium wave aerial and oscillator coils, output transformers, volume control, sundry resistance and condensers, dial and knobs. Case finished in brown crackle. Dial calibrated 150-550 metres, 5 valves to suit. One each, either GT or metal: 6SA7, 6K7, 6V6, 6K7, OZ4.
LASKY'S PRICE **£5.5/-**. Carriage 5/- extra. Or less valves, **69/6**. Carriage 5/- extra. Other chassis in various conditions of completion are available for personal callers only.
CIRCUIT for 5 valve car radio, using above chassis. PRICE **1/6**.

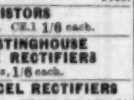
CAR RADIO AERIALS

Chrome 2 section telescopic. Extends to 75 inches. 2 bolt side fixing. Complete with 48 inches of co-axial cable. Suitable for T.V. use.
LASKY'S PRICE **15/-**. Postage 3/6 extra

DE LUXE T.V. CABINETS

Our new 1954 Mark II model. For 12in. c.r. tubes. Finished in beautiful figured walnut veneer, with either light, medium or dark polish. Supplied complete with mask, glass, back, speaker-baffle and fret, castors and c.r.t. neck protector. Inside dimensions: 16½in. deep, 17½in. wide, 28in. high. Overall height 33in. and width 18½in.
LASKY'S PRICE **£8/10/-**. Carriage 12/6 extra.
This cabinet can be supplied with aperture for 16in. or 17in. c.r.t. at no extra charge.

COLLARO 3-SPEED AUTO CHANGERS. Model 3RC/521. New and unused in maker's carton.



Cream or fawn finish
Complete with h i - f i d e l i t y "studio" turn over crystal pick-up.
LASKY'S PRICE **£9.19.6** Carriage Free.

BRIMISTORS

CE.3 **9d.** each. CE.1 **1/6** each.

WX6 WESTINGHOUSE MINIATURE RECTIFIERS

Wire ends, **1/6** each.

S.T.C. SENTERCEL RECTIFIERS

R.M.1	3/10	K3/40, 2.2 kV.	6/-
R.M.2	4/3	K3/45, 3.6 kV.	8/2
R.M.3	5/-	K3/50, 4.6 kV.	9/8
R.M.4	18/-	K3/100, 8.0 kV.	14/6
		K3/160, 12.8 kV	21/6

METAL RECTIFIERS

6 or 12 volt F.W. Bridge

2 amps.	9/-	6 amps.	21/-
3 amps.	9/11	10 amps.	32/6
4 amps.	12/11		

6 volts		12 volts	
½ amp.	2/6	½ amp.	3/11
1 amp.	4/6	1 amp.	6/6

3-WATT MIDGET AC/DC AMPLIFIERS

PUSH PULL, VERY HIGH GAIN.

4 valves: 2 UL41 in push pull, 1 UCH42 and 1 UAF42. Input voltage 100/110 AC/DC. Very easily converted to 230 volts. Supplied with circuit diagram and full details. Size:— 9 × 4 × 4 inches. Uses 2 metal rectifiers, 1 each RM2 and RM3. Ideal for ships record players, tape recorders, home record players, baby alarms, etc., etc. Supplied complete fully assembled and wired, with 4 valves. 60 M/A smoothed output for radio tuner, etc.
LASKY'S PRICE **69/6**. Carriage 3/6 extra.

12 INCH CATHODE RAY TUBES

Brand new, tetrode type t.v. tubes. 6.3v. heater, 10kV. E.H.T. Ion trap. 35mm. neck. Brilliant black and white picture. Special Offer. LASKY'S PRICE **£12/19/6** Perfect. Carriage and insurance 15/- extra.

SUPERHET COIL PACKS

For 465 Kc/s. No. 1 L.M.S., **19/11**. No. 2 M.S.S., **16/-**.

I.F. TRANSFORMERS

Miniature Type 465 Kc/s. ¾ × ¾ × 2¼in. PRICE **9/6** pair.
Midget Type 465 Kc/s. 1 × 1¼ × 2¼in. PRICE **8/6** pair.
Wearite Type 550. 445-520 Kc/s. **8/6** per pair.
Wearite Type 500. 450-470 Kc/s. **8/6** per pair.

R.F. OSC. COIL KITS

Consisting of R.F. oscillator A.T. coil with EY51 heater winding, EY51 rectifier, 6V6 valve and base. All necessary condensers and resistances.
Full circuit and data supplied.
6-9 Kv. LASKY'S PRICE 47/6.
9-15 Kv. LASKY'S PRICE 53/6.

E.H.T. OSC. COILS

10 Kv. PRICE **10/6**
18 Kv. PRICE **25/-**

L. AND M. WAVE T.R.F. COILS

With circuit. **4/6** pair.

L. AND M. DUAL WAVE S'HT COILS

Aerial and Oscillator. **5/11** pair.

CRYSTAL DIODES

Glass type, wire ends. **1/6**.

MAGNETIC RECORDING TAPE. SPECIAL OFFER

Plastic Tape by famous British manufacturer On Cyldon metal spools. 600ft. **6/11**. Postage 1/6 per reel extra.

TELESCOPIC PORTABLE AERIAL MASTS

Lightweight, but extremely strong alloy. Extends to 15 feet. Guyed at top and centre. Complete with all guy lines.
LASKY'S PRICE **39/6**. Carriage 2/6.

HIGH VOLTAGE CONDENSERS

.001 mfd., 12.5 Kv.	7/6		
.0005 mfd., 15 Kv.	6/6		
.0005 mfd., 10 Kv.	5/6		
.04 mfd., 12.5 Kv.	7/6		
.1 + .1 mfd., 3.5 Kv.	6/11		

P.M. LOUDSPEAKERS

All with 2 ohm speech coil.

2½in.,	15/-	5in.,	14/6	6in.,	19/11
3in.,	14/6	6½in.,	15/-	10in.,	19/6
4in.,	13/6				

LASKY'S LINE TRANSFORMER

RF.EHT for line flyback. 6-8Kv. with EY51 heater winding. Suitable for home construction T.V., **19/6** each.

ARMOUR PLATE GLASS

14in. Actual size 17½ × 15½ × ¼in.	7/11
15in. Actualsize 16½in. × 13in. × ¼in.	6/11
12in. Actualsize 13in. × 10½in. × ¼in.	4/-
9in. Actualsize 9in. × 8in. × ¼in.	3/-

C.R.T. MASKS. Brand New

LATEST ASPECT RATIO

9in.	7/-
10½in.	7/6
12in.	15/-
12in. Flat Face	15/-
12in. Old Ratio	9/6
14in. Rectangular	12/6
15in. Cream rubber	17/6
16in. with fitted safety glass	22/6
16in. Plastic, white	12/6
16in. Double D	31/6
17in. Rectangular	15/-

CYLDON 5-CHANNEL SWITCHED TELETUNER

Brand new. Instant and positive selection of any one of the 5 B.B.C. television channels, by a single control knob. Uses EF.80 or 6BW7 RF pentode and ECC81 or 12AT7 Double Diode Triode as frequency changer.
Tuning is obtained by switching incremental inductances. Size: 4½ × 2½ × 2½in. Spindle 2½in. long, ¼in. diameter. I.F. Output 9.5-14 Mc/s., noise figure on all channels better than 10.5dB., I.F. rejection better than 45dB. on all channels. Power gain 24dB.
LASKY'S PRICE, less valves, **12/6**. Postage 2/6 extra.
Complete with valves. **37/6**. Postage 2/6.

THE TELE KING

5 Channel S'het T.V. RECEIVER. Full constructional data, and all wiring diagrams for home construction, **6/-**.
ALL COMPONENTS IN STOCK.

FAMOUS MANUFACTURERS TAPE RECORDER AMPLIFIERS

Complete with 5 valves. For 200-250 volts A.C. mains. Finest quality components throughout.
Twin inputs. Volume control, and record level control. Speaker on/off switch. On steel chassis, black crackle finish. Size 11½ × 5½ × 9in. Valve line-up: 2 6V6, 2 6SN7, 1 5Z4. Full circuit supplied. Complete with 8in. speaker and all valves.
LASKY'S PRICE **£7/15/-**.
Or with Head Lift Transformer **28/15/-**
Carriage 5/- extra.

SPECIAL OFFER. BY FAMOUS MANUFACTURER. FRUSTRATED EXPORT ORDER

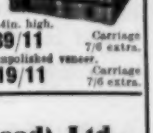
6 VOLT D.C. RADIO RECEIVER.

Uses 4 valves, vibrator and metal rectifier. Valve line up: ECH33, EF39, EBC33, EL32. 5in. P.M. Speaker fitted. In attractive polished walnut veneer cabinet. Size 19 × 8 × 15in. Full vision dial, battery economy switch, p.u. sockets, tone control. Superhet. Wavebands: 200-500 metres; 50-120 metres; 20-50 metres; 10-20 metres.
BRAND NEW AND UNUSED. COMPLETE WITH VALVES.
LASKY'S PRICE **£9/19/6**. Carriage and packing 10/6 extra.

STANDARD 5-VALVE SUPERHET RECEIVER

For use on 110-250 volts A.C. mains. Uses the latest type all glass valves: 1 each ECH42, EF41, EBC41, EZ40 EL41. In very attractive two tone walnut veneer cabinet, with fully illuminated dial. I.F. 465 Kc/s. P-U. sockets fitted. Waveband coverage: 200-550 metres; 31-92 metres; 10-32 metres. Cabinet size 16½ × 7½ × 12in.
SUPPLIED IN PERFECT WORKING ORDER, COMPLETE WITH VALVES.
LASKY'S PRICE, BRAND NEW, **£9/19/6**.
SOILED, **£7/19/6**. Carriage 10/6 extra.

TABLE TELEVISION CABINETS



For 12 and 14 inch C.R. tubes. Beautifully finished in polished medium walnut veneer. Complete with mask, glass, speaker-fret. Internal dimensions: — 16in. wide, 16in. deep, 14in. high.
LASKY'S PRICE **39/11** Carriage 7/6 extra.
Also available in unpolished veneer.
LASKY'S PRICE **19/11** Carriage 7/6 extra.

LASKY'S RADIO

Lasky's (Harrow Road) Ltd.,

370 HARROW ROAD, PADDINGTON, LONDON, W.9

(Opposite Paddington Hospital)

MAIL ORDER AND DESPATCH DEPARTMENTS, 485/487 HARROW ROAD, PADDINGTON, LONDON, W.10
Telephones: CUNningham 1979 and 7214 ALL DEPTS. Hours: Mon. to Sat. 9.30 a.m. to 6 p.m. Thurs. half day 1 p.m.
TERMS: Pro forma, Cash With Order or C.O.D. on post items only. Postage and packing on orders value £1—1/- extra; £5—2/- extra; £10—3/6 extra. Over £10 carriage free, unless specifically stated otherwise.

OUTSTANDING OFFERS

- **TRANSMITTERS**
  RCA ET-4336, Hallicrafters, BC-610, GO-9, all with accessories.
- **RECEIVERS**
  AR-77, AR-88, BC-348.
- **TRANSMITTER-RECEIVERS**
  W/S Nos. 11, 17, 18, 38, 58, 68. SCR-522, SCR-610.
- **RADAR EQUIPMENT**
  APS-3, APS-6, BM-1, BN-1, VP, AN/PA, Mk. 26 and AN/APN Series of Radio and Radar Equipments.
- **TEST EQUIPMENT**
  TS-10A/APN, TS-36/AP, TS-51/APG-4, TS-56A/AP, TS-127/U, IE-46, Type 205A, Type LR-1, BC-221, AN/UPM, SE-2, 79-B, W1117, etc.
- **MOTORS**
  Accelerating, Aircraft, Generators, Dynamotors, Inverters, Rotary Converters, wide range of U.S. production.
- **SPARES**
  (Radio and Radar U.S.A.) Full range of spares for most U.S.A. Aircraft, Naval and Ground Radio and Radar Units. (SCR-187, 188, 193/269, 274-N, 287, 399, 508-10, 17, 536, 566, 593, 608-10 (very large quantities), 694, 695, MRN-3, TRA-1-ABK, BM, BN, SM, SO, SQ, SK, APS-2, 3, 4, 6, 15, etc.), Klystrons 2K33.
- **AIRCRAFT INSTRUMENTS & ACCESSORIES**
  British and U.S. Catalogue supplied only to Governments, Airlines and Accredited Government Contractors.

SPECIAL EQUIPMENT (NOT ADVERTISED ABOVE) AVAILABLE FOR N.A.T.O. GOVERNMENTS AND THEIR ACCREDITED CONTRACTORS.

All enquiries to be addressed exclusively to

BRITISH SAROZAL LTD.
(Head Office)
1-3 MARYLEBONE PASSAGE, MARGARET ST., LONDON, W.1
Telephone: LANgham 9351 (3 lines). *Cables: Sarozal, London*

ALL EQUIPMENT AS ADVERTISED IS AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK AND IS FULLY CHECKED AND TESTED—PRIOR TO DESPATCH—IN OUR OWN WORKS AND LABORATORY.

A.R.B. and A.I.D. approved

ELECTRONIC ENGINEERS

who are qualified and experienced are invited to apply to:

MARCONI'S WIRELESS TELEGRAPH CO. LTD

for positions connected with expanding activities in the following fields:

Micro-Wave
wide band telecommunication systems

Airborne
communication and navigational aid equipment

Centimetric Radar
transmitters, receivers and associated equipment

Permanent and pensionable positions, some of senior status. Write quoting Ref. S.A. 49 to Dept. C.P.S., Marconi House, 336/7 Strand, W.C.2

THE
BRITISH NATIONAL RADIO SCHOOL
ESTD. 1940

NOW IN OUR FOURTEENTH YEAR AND STILL

NO B.N.R.S. STUDENT HAS EVER FAILED

to pass his examination(s) after completing our appropriate study course.

FREE TRIAL LESSON, QUESTION and MODEL ANSWERS
—Radio, Telecoms., Maths.
and our ***NEW BASIC TELEVISION.***
State subject and grade of any special interest.

A.M.Brit.I.R.E. and CITY and GUILDS Radio and Telecommunications Exams., etc., etc.

PRINCIPAL, M.I.E.E., M.Brit.I.R.E.
BRITISH NATIONAL RADIO SCHOOL
2, CANYNGE ROAD, CLIFTON, BRISTOL, 8
Tel: BRISTOL 34755

MAKE A GOOD DEAL

We pay TOP CASH PRICE for—

U.S.A. TEST GEAR

TS174, TS175, TS13, TS62, TS56, TS35, TS45, TS47, TS69, TS127, TS12, TS3, **BC221** or LM series. TSX—4SE, TS148, TS120 and any other unit with TS prefix.

RECEIVERS

AR88, S27, S27CA. **R54/APR4** and tuning units. 16, 17, 18 & 19. APR 5. **R89/ARN5,** BC733D, R5/ARN7. R65/APN9. R1294 R1359 P58 and any VHF or Centimetric receivers, etc.

TRANSMITTERS

ET4336, ART13, ARC1 and Collins TCS6, 12, 13, complete or parts required.

KLYSTRONS

723/AC, 707A, 707B, 2K33, 2K39, 2K40, 2K42, CV129.

£28 paid for **BC221** Frequency Meters.

ALL THE ABOVE URGENTLY REQUIRED

WE WISH TO PURCHASE any good equipment for communications or Laboratory work, including the above or British High Grade test equipment.

Please phone, write or call. Immediate attention given.

UNIVERSAL ELECTRONICS
27 LISLE STREET, LEICESTER SQ., LONDON, W.C.2
Phones: GERrard 8410 (day) **MEAdway 3145 (night)**

Wireless World Classified Advertisements

Rate 7/- for 2 lines or less and 3/6 for every additional line or part thereof, average lines 6 words. Box Numbers 2 words plus 1/-. (Address replies: Box 0000 c/o "Wireless World" Dorset House, Stamford St., London, S.E.1.) Trade discount details available on application. Press Day: August 1954 issue, Tuesday, June 29th. No responsibility accepted for errors.

WARNING

Readers are warned that Government surplus components and valves which may be offered for sale through our columns carry no manufacturers' guarantee: Many of these items will have been designed for special purposes making them unsuitable for civilian use, or may have deteriorated as a result of the conditions under which they have been stored. We cannot undertake to deal with any complaints regarding any such items purchased.

NEW RECEIVERS AND AMPLIFIERS

ALL types of audio equipment designed and built to order, tone compensation units. Williamsons, ultra-linear, pre-amps, electronic mixers, and all amplifiers up to 1kW. Extended payments available above £20.—Bernard J. Brown, 53, Goldhawk Rd., London, W.12. [0024

C.J.R. ELECTRICAL & ELECTRONIC DEVELOPMENT, Ltd., Bickford Rd., Witton, Birmingham, 6 (Eas. 0435), the Midlands specialist manufacturers of high fidelity sound reproduction equipment for the world-famous Williamson amplifier and associated accessories, including tone control stages, loudspeaker crossover units, distortionless contrast expenders and radio feeders; send for details and prices. [0105

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

RECEIVERS R1155, £5/17/6; R1155N, £9/10; carriage paid.
TRANSMITTERS 1154, 30/-.
TRANSMITTER-RECEIVERS TR/9, 47/6.
POWER units (motor generator type), 20/-; and a host of other ex-aircraft radio and electrical items; send your enquiries.
STARAVIA (Disposals Division), Blackbushe Airport, Camberley, Surrey. [2955

EDDYSTONE 640 receiver, as new; £15.—Martin, 15, Reigate Rd., Pomphlett, Plymouth. [2918

H.R.O. Senior, power pack, 4 G.C. coils, W.B. speaker, manual, little used, practically new; £35.—Box 5259. [2906

HALLICRAFTER SX28, recently overhauled, recalibrated Webb's Radio regardless of cost, offered at £45.—James, Wireless College, Colwyn Bay. [2902

HRO Rx's and coils in stock, also AR88, BC348R, CR100, etc.—Requirements please to R. T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0053

R.F. Units, types 26 @ 37/6, 25 @ 17/6, 24 @ 12/6, brand new in original cartons.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [2877

FOR sale, new, war surplus AR88D SX28 and H.R.O. receivers, with bandspread coils, etc., view and trial.—Weston Radio, 105, Claybrook Rd., Hammersmith, London, W.6. [2903

VORTEXION 15-watt amp, complete with gramo, motor and turntable, two 12in Rola speakers on baffles and microphone on adjustable stand, in perfect order; £25.—Box 5709. [2985

H.R.O. Senior Receiver, p.p. and 7 coils, good condition, offers over £24; 19in self-standing 5ft 5in rack; R.C.A.-R.V.T. 15B aircraft 'phone, X.T.R.—Cyril Hunt, Sheringham, Norfolk. [2919

FOR sale, bargain, battery S.W.Rx, 2 valves, complete with add on amplifier stage, good Dx, cover 180 to 8m, extremely portable, perfect for outdoor use with phones; £3/3, 5/- post.—Box 5735. [3004

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND WANTED

CHALLICRAFTER communication receiver model S.27 in any condition.—Box 5034. [2862

LOUDSPEAKERS—SURPLUS AND SECONDHAND

UNUSED Hartley 215 loudspeaker and bass baffle, cost £27; accept £15.—Matthews, 43, Clarkson Avenue, Wisbech, Cambs. [2959

TEST EQUIPMENT—SURPLUS AND SECONDHAND

AVO electronic testmeter, little used; £27.—Hall, 89, Preston Old Rd., Blackpool. [3020

TAYLOR 6SB sig.-gen., as new, instructions, spot-freq. 1/F's; first £6/10 secures.—D. & J. Draper, 4, Empress St., Accrington. [2939

SIGNAL generators, oscilloscopes, output meters, valve voltmeters, frequency meters, multi-range meters in stock; your enquiries are invited.—Requirements to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0056

The
PARTRIDGE
Output Transformer UL2

A 'C' Core Transformer
for use in
HIGH QUALITY A.F.
REPRODUCING EQUIPMENT

This new Partridge p.p. output Transformer reproduces full A. F. range with very low distortion. **Each half primary is brought out to terminals as a separate winding and is tapped at 45% of the turns.** Characteristics of the UL2 permit considerable negative feedback being taken from the secondary and fed to a point three or four stages back. The unit is hermetically sealed.

The Referred Primary Loading requirements of all modern valves are covered by the standard models.

FREQUENCY CHARACTERISTIC

Flat within ± ½ db between 30 and 30,000 c/s.

★ **POWER RATING:** *50 watts at 60 c/s. 14 watts at 30 c/s for less than 0·5% harmonic distortion.*

★ **FINISH:** *Bronze coloured stove enamel.*

★ **SIZE & WEIGHT:** *3¼" x 3¼" x 3⅝" high excl. terminals: 3¼ lb.*

★ **FIXING:** *2⅞" x 2⅛" 4 screws supplied.*

Price **£8: 15: 0** EX WORKS

Write for Technical Data Sheet No. 6

PARTRIDGE
TRANSFORMERS LTD
TOLWORTH SURREY

TEST EQUIPMENT—SURPLUS AND SECONDHAND

YOUR Universal Avominor can read a.c. amps, special mu-metal transformer for any 4 ranges (max. 10 amps) and full details, 30/-; no mods. to instrument necessary.—Send now to H. L. Brown, 16, Rowan Rd., Walsall. Tel. 4888. [2957

A.F. sig. generator for sale, covers approx. 20c/s to 50kc/s 1%, sine and sq. outputs, attenuator, etc., complete with data sheets, in guaranteed perfect wkg. order; £9 only, bargain, must sell; send s.a.e. for fullest details.—Box 5730. [3005

METERS WANTED

WE urgently require meters of all types, meter components, test equipment, etc.; any quantity large or small; prompt cash or offer by return.
ANDERS Electronics, Ltd., 91, Hampstead Rd., London, N.W.1. Euston 1639. [2778

NEW DYNAMOS, MOTORS, ETC.

ALTERNATORS, 230/1/50, 400VA, self-energised 3,000rpm, ball bearing, £23/15 del., also special television model same price; voltage regulator 30/- extra.
J.A.P. No. 2A 1.2hp petrol engine, air-cooled, 4-stroke, starting rope, tools; £17/10 delivered for above alternators.
SPECIAL rotary converters, guaranteed interference free, fitted radio and television filters, wt. 60lb, d.c. input 12v 300va, out. 24v, 32v, 50v, 110v, 230v d.c. to 230v, out. 250va, £28/10 del.; also converters for radiogram and general use, inputs, outputs and prices as above; the above also supplied without smoothing, £25 del. immediate despatch; trade supplied.
AT a purchaser's home 60 mls. S.W. of Sutton Coldfield a 24v.
TELEVISION converter was tested on Ekco television, 12in tube, stated consumption 135 watts d.c. current from battery only 9½amps, picture and sound were perfect and completely free of interference or flutter.
THE above are the latest products of British manufacture, and are guaranteed for one year; fullest details of plant, alternators or 400AV alt. or rotary converters, by return post; state which required; terms c.w.o. pro forma invoice c.o.d. (post goods only).
T. W. PEARCE, 66, Great Percy St., W.C.1 (near Angel). [0013

BATTERY chargers, 4 models, 2-6-12v, 1-2-4 amp D.C. any mains voltage; also larger types special transformers, chokes, test gear, interior car heaters, etc.—The Banner Electric Co., Ltd., Hoddesdon, Herts. [0112

ALL types of rotating electrical machinery up to 20kva available, including rotary converters, rotary transformers, motors, petrol and diesel-engined generating plants, alternators and d.c. generators. We are also in a position to quote for power transformers; as actual manufacturers we will be glad to quote for any quantity for home or export.
DIESEL Electric generating plants, 5kva, 230v, with push-button remote control, starting equipment ready for use; £225.
CHAS. F. WARD, Lordscroft Works, Haverhill Suffolk. Tel. 253. [0059

DYNAMOS, MOTORS, ETC.—SURPLUS AND SECONDHAND

AS new E.D.C. rotary converter, 230 a.c. to 200 d.c., 250 watts, fully suppressed; £30 or offer.—Box No. 5576. [2956

NEW GRAMOPHONE AND SOUND EQUIPMENT

FERROGRAPH magnetic tape recorder. 76gns.
WEARITE tape decks and component parts.
DISC recording machines and blank discs.
LEAK amplifiers, 10w £17/17; preamp £10/10.
GOODSELL, 5w £13/10, preamp £10/10.
RESLO ribbon microphones and stands.
EVERYTHING for the professional recording studio and quality dealers.
SOUND DISCS (SUPPLIES), Ltd., 178, Bispham Rd., Southport, Lancs. Tel. 88153. [2314

BUYING a new amplifier or rebuilding the present one? See Bernard J. Brown's adverts under New Receivers and Amplifiers, also Repairs and Service. [0029

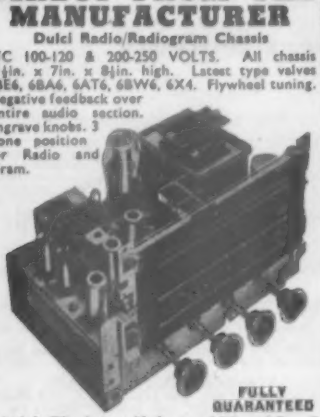
HIGH fidelity, v.h.f., F.M. tuner units, a new receiver, entirely self-contained, mains driven, 8-valve miniaturised chassis, 2 watts output at extreme ranges, price includes aerial and new type H.F. 810 W.B. speaker; £25; demonstration daily; see also display advert. page 134.—Bel, Marlborough Yard, Archway, N.19. Arc. 5078. [0165

CINE-VOX disc recording equipments, type CT.1 for high-quality recordings from existing microphone equipment; price from 28gns; also available as a complete channel inclusive of mic., amplifier and playback equipment, at 70gns; type C7, for highest quality professional requirements—recorder mechanism at 46gns, or complete channel at 110gns; demonstrations arranged in London.
PLEASE write for details to K.T.S., Ltd., "Coplow," Park Rd., Braunton, N. Devon. Tel. Braunton 224. Callers by appointment only [0209

DIRECT FROM THE MANUFACTURER

Dulci Radio/Radiogram Chassis

A/C 100-120 & 200-250 VOLTS. All chassis 11¼in. x 7in. x 8¼in. high. Latest type valves 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Flywheel tuning. Negative feedback over entire audio section. Engrave knobs. 3 Tone position for Radio and Gram.



FULLY GUARANTEED

Model B3, Long, Med., Short (5 Valves)	£12. 12. 0
B3 Plus Push Pull Stage (6 Valves)	£15. 15. 0
B3 Double Feature P/Pull & RF Stage (7 Valves)	£18. 18. 0
Model B6 Six Wavebands Med, L, 4 Short (Bd-Spread)	£15. 15. 0
B6 Plus Push Pull Stage (6 Valves)	£18. 18. 0
B6 Double Feature P/Pull & RF Stage (7 Valves)	£23. 2. 0

ALL PRICES TAX PAID. Escutcheon for 9in. x 5in. dial, 4/9 extra. Matching speakers P.M. type 3 ohms 8in or 10in available. **Money back guarantee.** Free particulars from the Manufacturers.

THE DULCI CO. LTD.
97 VILLIERS ROAD, LONDON, N.W.2
Telephone: Willesden 7778

SURPLUS

- **TRYLON LATTICE LADDER TOWERS.** 50ft. high triangular section. 12in. wide. Highest quality, with all hardware. New, in original cases. £40.
- **DIRECTION FINDING EQUIPMENT** for SCR-291, SCR-206, SCR-503, SCR-235, SCR-551, SCR-555, SCR-556.
- **TRIPLE DIVERSITY RECEIVERS.** 1.5 to 30 Mc/s. Built-in loudspeaker and power supply. Fully metered. Precision H.F., L.F. and B.F. Oscillators. Variable gain and selectivity. Band pass and tone facilities. Full details and photo available.
- **100 WATT BROADCASTING TRANSMITTERS.** Made by Woden. Self-contained in 4ft. 6in. cabinet. Input 190/250 v. A.C Output 250 watts Triode H.T. 2,200 v. Fully valved. £22/10/-.
- **RACKS.** 5ft. 6in. high (A), channel iron sides, drilled and tapped shock base de Luxe £3/10/-. (B) as A only 3ft. 6in. high, 49/-, (C) 5ft. 6in high, angle iron sides, plain base. 35/-.
- **LARGE VALVES.** 4212 (250 watts), GU-50, VT-26C, DET-12, VU-29, 830B.
- **R.C.A. HIGH POWER LOUDSPEAKERS.** 25 watts. Finest quality waterproof construction with output transformer. Can be heard a mile away. £14.
- **TRANSMITTING COMPONENTS.** Transformers, chokes, condensers, large variety up to 20,000 volts.
- **INSULATORS.** Large quantities of over 50 different types.

WANTED. Technical Manuals or Data of any American or British Service equipment.

Many other items too numerous to mention. Send your requirements. Lists available. All packing and shipping facilities.

H. HARRIS
ORGANFORD DORSET
Telephone: Lychett Minster 312

GRAMOPHONE AND SOUND EQUIPMENT —SURPLUS AND SECONDHAND

DISC recording; Presto K.8 portable, complete, £55; Presto K.10 portable, complete, £65; each with spares, valves, etc.: £110 the 2. JOHN KING (FILMS), Ltd., Film House, East St., Brighton. [2834

E.M.I. disc recorder model 2300, two mikes, blanks, new condition; £65; buyer collects.—Davies, 26, Pier St., Aberystwyth.

CHANCERY G35 LP gramophone attachments, quantity about 1,000, unused, lying in Australia, for sale, what offers? freight paid.—Box 5711. [2968

TRUVOX Tape Deck Mark III (latest model), unused, in maker's sealed carton; genuine bargain, 19gns.—Dumville, 11, King's College Rd., N.W.3. [2931

GRUNDIG TK9 Tape Recorder, one month old, cost £74/11 with M.C. mike and tapes; will accept £62.—Chandler, 167a, Ashley Rd., Hale, Altrincham, Cheshire.

SURPLUS to requirements: new, unused, 1954, 2 Brierley microarmature pick-ups, diamond points, one 7/6, one L.P., £15 pair (without transformer).—Ormerod, 21, Tewkesbury Ave., Blackpool, S. [3024

E.M.I. portable disc recorder, model 2300H, 3-unit construction, leatherette cases, high quality ribbon microphone and 10-watt quality amplifier, also suitable public address; as new; £90 o.n.o.—B. Richards, 4, 65, Phillips Ave., Worcester Park, Surrey. Der. 2602. [2904

TRANSMITTING EQUIPMENT

SCR522, ET4332B T.U.s for BC375, T1151, TR1430 TR1143A offered.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [2708

NEW COMPONENTS

CRYSTAL microphone inserts (Cosmocord or Mic-6), guaranteed brand new; 15/6, post free.—Radio-Aid, Ltd. (Retail Dept.), 29, Market St., Watford. [0036

TRANSISTOR loudspeaker receiver, daily demonstration, also Associated miniature components; new potcored coils, whistle filters, to order. F.M. coil sets, 55/- and 75/-.—Bel, Marlborough Yard, Archway, N.19. Arc. 5078.

FLUORESCENT fittings. Special reduced price offer, 4ft 40w white stoved batten complete with ballast starter and tube, ready to plug in, 210/240v a.c 59/6; these are neat compact fittings suitable for home and workshop.—Malden Transformer Supplies, Malden Rly. Station, New Malden, Surrey. Mal. 2655.

COMPONENTS—SURPLUS AND SECONDHAND

BENTLEY, Ltd., 36, Chalcot Rd., N.W.1. Primrose 9090, for speediest mail order, offer:—

GUARANTEED miniature valves.—OZ4 at 5/6, 1A4 7/6, 1A5 5/6, 1A7 14/6, 1C5 7/6, 1C4 6/-, 1C6 6/6, 1LA6 8/-, 1LC6 at 8/6, 1LD5 4/6, 1LN5 4/6, 1P5 10/6, 1Q5 10/6, 1T4 10/6, 2A3 9/6, 2D7 10/6, 2C26 12/6, 2X2 4/6, 2C34 1/9, 5A8 17/6, 5D7 8/6, 5D6 2/-, 5Q5 12/6, 6A3 10/6, 6AG5 5/6, 6AQ7 15/-, 6B4 7/6, 6C8 8/-, 6B5 9/-, 6F7 8/-, 6F8 7/-, 6G5 7/-, 6G6 6/6, 6H8 10/6, 6J6 7/-, 6J8 10/6, 6K6 6/6, 6L6 7/6, 6L7 7/6, 6N7 7/6, 6R7 8/6, 6SG7 10/-, 6SH7 5/-, 6SR7 8/6, 6ST7 5/-, 6Y7 15/-, 7A4 8/6, 7A7 9/6, 7B6 8/6, 7B8 7/6, 7C7 8/6, 7E5 8/6, 12A5 7/6, 12AH7 12/6, 12H6 3/-, 12SC7 7/6, 12SH7 5/6, 12SR7 7/6, 12Z3 8/6, 13D1 8/-, 13D3 8/-, 14E6 10/6, 14F6 10/6, 25Y5G 8/6, 27 7/6, 30 7/6, 39/44 5/-, 41MDG 12/6, 41 10/6, 55 12/6, 56 12/6, 57 8/6, 58 8/6, 70L7 15/6, 76 7/-, 83 10/6, 85 10/6, 154V 7/6, 813 70/-, 866 15/-, 955 5/-, 1299 5/-, 1622 9/-, 1626 8/6, 7193 2/6, 9002 6/-, 9005 6/6, A20B 4/-, A25A 10/6, A27D 17/6, A30D 5/6 A36B 10/6, A40M 10/-, A50A (7-pin) 7/6, (5-pin) 5/-, A50M (7-pin and 5-pin) 7/6, A70C 12/6, A80A 10/6, AB1 4/-, AC/P (6-volt) 6/6, BL63 7/6, C10B 8/6, C20C 4/-, C23B 7/6, C30B 6/-, C36A 10/6, C50B 2/6, C50E 5/-, C70E 12/6, CV6 1/6, CV775 4/-, CV210 45/-, CV271 10/6, CV175 12/6, CV286 10/6, CV287 10/6, CY505 9/- CY1C 8/6, D43 5/-, DC2Pen 15/-, DC/SG 15/-, DC3/HL 10/6, RC/HL 10/6, DH 10/6, DPT 15/6, DV5G 15/-, E1143 1/6, EL3 10/6, EL33 15/6, HD21 7/6, K25B 8/6, K30B 2/-, K50G 4/6, K35A 12/6, K40B (5- & 7-pin) 8/6, K40N 7/6, K50N 10/6, K50M (5- & 7-pin) 8/6, K70B 5/6, K77B 7/6, K80A 10/6, K80B 10/6, KTW62 5/-, ME1400 12/-, MPT4 (5-pin) 12/6, (7-pin) 10/6, MP41 7/6, OM5 7/6, OM5P 10/6, Pen20 12/6, PM256 5/-, RK34 2/-, RL18 7/6, SD4 17/6, SG2 7/6, SG215VM 7/6, TDD2 8/6, TH4 10/6, TP20 10/6, UR2 10/6, VDS 15/-, VP20 15/-, VR53 5/-, VR54 2/-, VR55 7/6, VR56 4/6, VR57 8/-, VR91 5/-, VR136 5/-, VT501 6/-, VU111 3/-, VU120A 3/-, WD30 17/6, WD40 17/6, X66 7/6, X75 10/6, 2152 10/6. Hundreds of other types in stock.

ELECTROLYTICS. All cans: 16×8×8mfd 500v 5/6, 8×8×8mfd 400v 3/-, 16mfd 500v 2/9, 8mfd 500v 2/-, 32mfd 350v 2/-, 24mfd 350v 1/9, 4mfd 200v micropack 1/-, 12mfd 50v micropack 9d, L.F. Chokes, 500ohm 3/-. NEW surplus multi-ratio semi-midget output transformers, 2/-; 550ohm and 100K wirewound pre-set pots, 1/6; Volume controls 50K, less switch 1½in spindle, 1/-; 5in to 100K short spindle, 6d; with switches 50K, 10K, 3/-; ½meg, 1meg, 2meg, 3/6; Westectors WX6, W1, 9d; metal cased condensers, 0.01, 0.001, 0.002, 0.005mfd, 4/- doz.; 0.1mfd 350v Micamould, 6/- doz.

NEW wirewound vitreous resistors, 10watt 40, 70, 75, 90, 150, 250, 270, 500, 680, 680, 800, 1K, 1.5K, 2K, 2.2K, 2.7K, 3.2K, 3.5K, 4.5K, 4.7K, 5K, 6.5K, 7.5K, 15K, 20K, 25K, 30K, 35K, 39K, all 1/- each; 20watt, 100, 400, 500, 850, 1K, 10K, all 2/- each; Rectifiers Selenium, RM4, 12/-, 260v 80ma 7/6.

WESTINGHOUSE, 250v 40ma, 4/-; 250v 80ma, 7/-; terms, cash with order or c.o.d.; postage extra; 24hr postal service; s.a.e. for free lists.

58 pages 16 Circuits for 2/6 only

Enlarged again!

Our Supa-Handbook, "The Home Constructor," with its supplements, now incorporates all the above **PLUS** supa-simplified layout and point-to-point wiring diagrams and FULL constructional details for building a variety of superhets **PLUS** full constructional details for building a superhet coil Pack **PLUS** pages of Radio Information, Resistance Colour Code, Formulae, etc. **PLUS** priced parts lists for all our circuits **PLUS** full constructional details for building a superhet Car Radio **PLUS** profusely illustrated catalogue.

YOU CAN'T GET BETTER VALUE! IT'S TOPS!

SEND FOR A COPY TODAY

SUPACOILS
(DEPT. W.7)
21, Markhouse Road, London, E.17

Excellence in design..

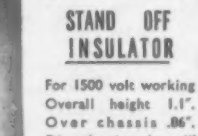
Specialists in Sub miniature Telecommunication Components

STAND OFF INSULATOR

For 1500 volt working Overall height 1.1". Over chassis .86". Dipped tinned spill .35". Thread and hexagon 6BA.

These are reproduced (approx) actual size

MINITRIMMER



Standard maximum capacities up to 13pF. Voltage 500 DC. Base ½" square with fixing centres for 10 BA ½" apart.

Details from—

OXLEY
DEVELOPMENTS CO. LTD.
ULVERSTON, NORTH LANCS
Tel: ULVERSTON 3304

COMPONENTS—SURPLUS AND SECONDHAND

SUPREME RADIO, 746b, Romford Rd., Manor Park, London, E.12. Tel. Ilf. 1260. Est. 19 years.
ALWAYS "Supreme" for "supreme" bargains.
NEW stocks electrolytics:
METAL can 1½in. 32+32mfd 350v 425v Surge, 4/6 ea.; 32+8mfd 275v 1in dia, Dryilitic cond., our price 2/9; 32mfd 350v, Dryilitic cond, 1/9 ea.
TUB/card wire end. 8mfd 450v, 1/11 ea; 16+8mfd, 500v, W/end sleeved, cond. 4/3 ea.
BIAS cond., 25mfd 25v, sleeved, 1/3 ea.
WIRE wound V/contd. with S/P switch and L/spindle, 25K ohms or 50K ohms; bargain price 4/6 ea. 3-watt rating.
CRYSTAL sets in brown bakelite case 3¼in×2¾in×1¾in, using a crystal diode, as dector; our bargain price 7/6 ea.
SMALL dia. V/controls with L/spindle and S/P switch, 1meg, ½meg or ¼meg ohm, 2/6 ea.
POPULAR value ½watt resistors, 5d ea. or 2/9 ass. doz.; R.M.4 metal recs., 15/11 ea.; R.M.1, 3/11 ea.; R.M.2, 4/3 ea.
STEEL chassis in grey finish, ready punched for S/het layout, 14in×6in×3in, 2/6 ea.
EARTH rods, 18in, copper tube type, 1/8 ea.
FUSE wire, 1amp, 2amp and 3amp, all 3 gauges on a card, price 6d a card.
HUNDREDS of other bargain radio and TV components in stock.
TERMS, C.W.O., no C.O.D. Send 9d extra for postage orders under £5; 2½d s.a.e. all enquiries and list. [0021

FREE list; sensational prices; valves, components.—Jack Porter, Ltd., College St., Worcester. [2975

GERMANIUM diodes, 1/- each; large quantities cheaper.—B. D. C., 591, Green Lanes, London, N.8. [2930

SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport Street, London, W.C.2. See our displayed advertisement, page 160. [0016

ELECTRONIC Components. Send stamp for interesting comprehensive bargain list. A. McMillan, 5, Oastfield Rd., Bristol, 6. [2846

HEAVY current transformer, 230v A.C., input 4-6 or 12v, output at 180amps; £4.—Box 5774. [3021

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. ELECTROLYTICS, capacity, voltage, size, type of mounting, price post paid: 4mfd, 6v, 1×½in, lug, 1/9; 250+250, 8v, 1×2in, lug, 2/-; 500+500, 6v, 1×3, lug, 2/6; 40+40, 150v, 1¼×2, clip, 2/9; 40, 150v, 1×2, clip, 2/6; 20+20, 275v, 1×2, lug, 3/3; 16+32, 275v 1×2, lug, 3/3; 16+16, 275v, 1×2, clip, 3/3; 50+100, 275v, 1¾×3, lug, 4/6; 100, 275, 350v, 1¼×3, clip, 5/6; 32+32, 350v, 1¼×2, clip, 4/-; 16+16+16, 350v, 1¼×2, clip, 1¾×2, 4/9; 16, 350v, ¾×2, lug, 1/9; 40+40, 500v, 1×3, lug, 3/6; 10, 450v, ¾×2, lug, 1/6; 16, 450v, ¾×2, tag, 2/9; 20, 450v, 1×2, 2/3; 32, 450/525v, 1¾×2, clip, 3/9; 50+50, 450v+20mf 25v, 1¾×3, lug, 5/-; 15+15, 450v+20mf 25v, 1¼×3, lug, 4/6; 200, 6v, ⅝×1⅛, clip, 1/6; 100, 12v, ⅝×1⅛, clip, 1/9; 8, 450v, 1×2, clip, 2/-; 50, 12v, ¾×1⅛, tag, 1/6; 150, 25v, ¾×1¾, clip, 2/-; 250, 12v, ¾×1⅛, wire 2/3; 16+16, 450v, 1¼×2, clip, 4/-; 40+40, 275v, 1¾×2, clip, 3/3; 24+24+16, 350/425v, 1¾×2, clip, 4/9; 60+200, 275/350v, 1¾×4¼, clip, 6/6; 4, 150v, ⅝×1⅛, clip, 1/1; 500, 12v, 1⅛×2⅜, clip, 2/-; 8, 350v, ¾×2, clip, 1/9; 32+32, 350/425v, 1¼×2, clip 5/-; 8+16, 450/525v, 1×2, clip, 4/-; 2, 450/525v, ¾×1¾, tag, 1/6; 2, 550v, ¾×1⅛, tag, 1/3; 8, 450v, ¾×2, clip 1/9; 32+32, 450/525v, 1¼in×3in, wire ended, 5/6; all all cans, some with sleeves, all voltages, WKG, surge where marked new stock, guaranteed.
TELEVISION! Set of 5 components, comprising line output trans., with E.H.T. winding to give 7kV, using EY51 (heater winding for EY51 also included), and fitted with width control scanning coils, low impedance line and frame, focus coil (res. 10,000Ω, current approx. 20 mA); the set of 5 for 42/-, plus 2/- post, diagram of line trans. supplied.
PERSONAL receivers, 3 valve T.R.F. using 1T4s, contained in handsome bakelite case with lift-up lid, size 7¼×6½×5in with lid closed, plastic carrying handle fram, AE in lid, these receivers cover the medium waveband and operate from self-contained, dry batts., standard types, W1435 and U2, output to a pair of lightweight 'phones (H.R.), controls, SM tuning and reaction, opening lid switches on, supplied brand new, with valves, batteries, 'phones, an ideal set for invalids, hos. patients, etc., these receivers are ex-Govt. surplus and are offered ready to play; carr. paid £4/10.
UNIVERSAL amplifiers, 8-valve 20watt A.C./D.C., black crackle chassis, and black and chrome cover, overall size 15½in×7½in×7in. First-class components (Partridge O.P.T., and driver, Gardiner choke, A.E.I. Mu-Metal input trans. for mike). Valves, 2×EF37, 4×CL33, 2×UR3C. Switched input for high or low imp., top cut and base cut switches, V.C., mains switch, mains plug and socket, 230-250v, isolated chassis, 15Ω output. Wired and tested, ready for use, with valves, brand new, £10/19/6, carr paid.
5mA meters, moving coil, bakelite case, 2in square, flush mounting, new, boxed; 8/- post paid.
MAINS trans., 250-0-250v, 80ma, 6.3v, 2.5A, 6.3v, 0.6A, Pri. 0-210-230-250v. 12/- post paid.
MAINS trans., Pri. 200/250v, sec., 305-0-350v, 80mA, 800v 5mA, 6.3v 4.2A 6.9v 0.4A, 2v 2A, 4v 1.1A, 5v 2.3A; these trans. have been taken from ex-Govt. equip.; some may have tag panels broken, but guaranteed O.K.; 13/- post paid; ideal for scopes.
RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. [0015

REAL HIGH FIDELITY

at modest cost . . .

● *Manufacturer-to-Consumer policy saves you ⅓ cost!!*

We are now specialising in the supply of units for making up high-fidelity Radio and Record-reproducing Equipments for use in the Home, small Halls, Schools and Gramophone Societies and single items for replacing in existing equipments and radiograms.
Our Chief Engineer, who is operating a Technical Guidance Service, is available daily, including Saturdays, from 10 a.m. to 6 p.m., or will deal with enquiries by return of post. Our new illustrated Catalogue and Supplement will be a great boon to those desiring high quality equipment for modest expenditure. Send two 2½d. stamps for your copy now. It may well save you pounds.

No. 1 "SYMPHONY" AMPLIFIER is a 3-channel 5-watt Gram/Radio Amplifier with astonishingly flexible tone control. You can lift the treble, the bass, or—and here is the unique feature—the middle frequencies to suit your own ear characteristics and the record or radio programme being heard. It is thus possible to arrange the frequency-response of the amplifier to a curve equal and opposite to the resultant curve of the other items in the chain so that what finally registers in the brain is as per original. This flexibility of control is far more important than mere nominal linear response of the amplifier, as the pick-up, speaker, etc., are not linear. Idependent Scratch-Cut is also fitted and special negative-feedback circuit employed. The Amplifier can accommodate a wide variety of records from old 78's to new L.P.'s. Input is for all types of pick-up of 0.2 v. output or more and there is full provision (and power) for Radio Tuner. It is available to match 2/3 or 15 ohms speakers. Price: 10 gns. (carriage 5/-). Fitted in Portable Steel Cabinet, 35/- extra.

No. 2 "SYMPHONY" AMPLIFIER as No. 1 but with 10-watt Push-Pull triode output and triodes throughout. Woden mains and output transformers and choke. Full provision and power for Tuner. Output tapped 3, 7.5 and 15 ohms. Competes with the most expensive amplifiers on the market yet costs only 15 gns. (carriage 5/-). Fitted in portable Steel Cabinet 2 gns. extra.

"SYMPHONY" AMPLIFIERS with REMOTE CONTROL. Both the above model Amplifiers are available with all controls on a separate Control Panel with up to 4 feet flexible cable which simply plugs into the amplifier. Enables the Amplifier proper to be set in the bottom of a cabinet whilst the controls are mounted conveniently higher up. Extra cost 2 gns.

"STUDIO SYMPHONY" AMPLIFIERS, Models 1 and 2, new models specially designed to get the maximum out of the revolutionary new Collaro Studio pick-ups and heads type "P." Specification as per our Standard Symphony models but with high-gain, low-noise, built-in Pre-amplifier stage with separate switched correctors for Std. and L.P. Third position on switch provides input matching for Acos and similar output pick-ups. These remarkable new models thus provide all the facilities and matching of our Standard Symphony Amplifiers PLUS the specialised Collaro matchings. See March issue of "The Gramophone" for review of these instruments. Price: No. 1, 12 gns.; No. 2, 17 gns. Carriage 5/-.

CURRENT GARRARD PRODUCTS AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK AT PRESENT.

3-SPEED GRAM UNIT MODEL "T" with new type turnover pick-up head, **£10/12/8,** post 2/6.

MODEL TA as above, but with plug-in turnover head, **£10/16/-,** or with two separate high fidelity Acos HGP35 heads, **£12/15/6.** Unit less heads, **£8/11/-;** post 2/6. Heads, 42/3 each, post 1/-.

MODEL TB as above but with long pick-up arm. Less heads, **£8/11/-,** post 2/6.
Heads to fit this unit: Decca XMS, 55/-, Decca Crystal, 35/-, Garrard Standard Magnetic, 25/-, miniature magnetic low impedance, 25/-, miniature magnetic high impedance, 35/-. Post on heads 1/-. Unit can be supplied with any combination of above heads and is carefully adjusted for stylus pressure on despatch.

RC110 NEW MODEL AUTO-CHANGER with new type turnover head, **£13/19/6,** carriage 5/-.

MODEL RC75A, less heads, **£15/4/6,** with new turnover head, **£17/9/6,** with two separate Acos HGP39 heads, **£19/16/-,** carriage 5/-.

RC80, less heads, **£17/1/7,** with new turnover head, **£19/6/7,** with two HGP39 heads, **£21/13/-,** with Garrard head for miniature fibres for Standard, and Decca crystal for LP, **£20/12/-,** carriage 5/-.

COLLARO latest model A.C.3/544 3-SPEED GRAM UNIT, with new "STUDIO" Pick-up type "O" or "P," **£10/6/1,** post 2/6.

COLLARO latest model 3RC531 AUTO-CHANGER. We are pleased to say that after most careful and rigorous trial, we can highly recommend these latest improved Auto-Changers by Collaro. The standard of engineering is of the highest and in addition to being very easy and quick and fool-proof in operation, they are fitted with the revolutionary high-fidelity plug-in "STUDIO" Pick-up heads of which the Type "O" is matched to radio sets and medium-gain amplifiers and the Type "P" is designed for high-gain amplifiers. The Type "P" is exactly matched to our new model Studio Symphony Amplifiers. The price complete with either type pick-up head is **£15/3/-.** The **3RC532** as above, but mixes 10-inch and 12-inch records, costs **£17/10/-,** carriage 5/-. Delivery from stock. Illustrated leaflet 2½d.

COLLARO "STUDIO" PICK-UP (Arm and Head) type "O" or "P," **74/8,** post 2/-.

ACOS GP20 Hi-g PICK-UPS. Arm with one HGP39 head (Standard or L.P.), **£3/8/9,** or with both heads, **£5/11/-.** Post 1/6. Heads separately, **42/3** each. Immediate delivery.

TRANSCRIPTION MOTORS IN STOCK.

COLLARO MODEL 2800, less pick-up, **£13/9/6.**

COLLARO 2010 with pick-up complete on unit plate, **£18/4/9.**

CONNOISSEUR, £21/17/3.

GOODMANS CORNER CABINETS for the AXIOM 150 Mark 2 manufactured by us to Messrs. Goodmans' measurements. Height, 46in. Price: complete kit in plain board with felt, **8 gns.** Price ready built, **10 gns.** Finished in figured walnut, **16 gns.** Other veneers to order. Carriage extra according to area.

"SYMPHONY" BASS REFLEX CABINET KITS. 30in. high, consist of fully-cut ¾in. thick, heavy, inert, non-resonant patent acoustic board, deflector plate, felt, all screws, etc., and full instructions. 8in. speaker model, **85/-;** 10in. speaker model, **97/6;** 12in. speaker model, **£5/7/6.** The design is the final result of extensive research in our own laboratory and is your safeguard of optimum acoustic results. Carriage 7/6. Ready built, **10/6** extra.

"SYMPHONY" BASS REFLEX CABINETS, as above but fully finished in figured walnut, oak or mahogany to our Registered Design and to match our Console Amplifier Cabinet, enabling the housing of a whole equipment in a two-piece suite, cost: 12in. speaker model, **£11/10/-;** 10in., **£11;** 8in., **£10/10/-.** Carriage according to area. The 10in. model is ideal for the WB HF 1012 (see "The Gramophone" review March).

CONSOLE AMPLIFIER CABINETS, 33in. high, lift-up lid with piano hinge take Gram Unit or Auto-changer, Amplifier, Pre-amplifier, and Radio Feeder Unit, finished medium walnut veneer to match our veneered Bass Reflex Cabinets. De Luxe version, **10 gns.,** carriage according to area.

HIRE PURCHASE FACILITIES
NOW AVAILABLE on orders of £15 or over.
Send one-third deposit with order, balance over 6 or 12 monthly instalments. *State which required.*

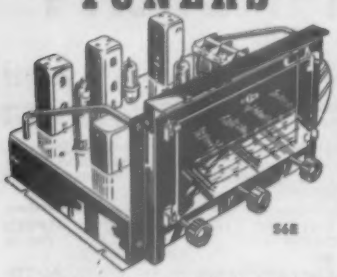
NORTHERN RADIO SERVICES

11 & 14 KINGS COLLEGE RD.,
ADELAIDE RD., LONDON, N.W.3.

Phone : PRimrose 8314

Tubes : Swiss Cottage and Chalk Farm.
Buses : 2, 13, 31, 113, 187.

—TUNERS—



S6BS 9 Band (6 Electrical band spread) with R.F. F.C. 2 I.F. Delayed Amplifier A.V.C. Variable Selectivity. Fly Wheel Tuning. Tropicalised. Suitable for use with any High Quality Amplifier. £44. Tax paid.

S6 A new model similar to the well-known S6BS but only 3 Wave Bands ; 16m-50m, 195m-550m, 800m-2,000m. £38. Tax paid.

S6E As S6 but 4 Wave Bands ; 12.5m-37m, 35m-100m, 90m-250m, 190m-550m. £39. Tax paid.

S5 3 Wave Bands, 16m-2,000m, R.F. pre-Amplifier, variable selectivity I.F. Delayed amplifier A.V.C. £21/6/8. Tax paid.

S5E As S5 but 12.5m-550m. £21/6/8. Tax paid.

S4 The Standard high-quality Feeder Unit. Specification as S3 but without R.F. amplifier. £16. Tax paid.

A modified version of all models is available for use with Leak, Acoustical and other High Quality Amplifiers.

C. T. CHAPMAN (Reproducers) LTD.
RILEY WKS., RILEY ST., CHELSEA, S.W.10
FLAxman 4577/8
Export Enquiries Invited

RADIO & TELEVISION COMPONENTS
WE OPERATE A PROMPT & EFFICIENT MAIL ORDER SERVICE.
"VIEW MASTER" & "TELE-KING" specialists
Easy terms available.
JAMES H. MARTIN & CO.,
FINSTHWAITE, NEWBY BRIDGE, ULVERSTON, LANCS.

LYONS RADIO Ltd.

80/150 M/C WAVEMETER TYPE W1053. This instrument consists essentially of two parts: (a) the indicator unit for observing resonance in the wavemeter. It comprises a D.C. amplifier, a peak rectification system, magic eye and power pack which operates from 230 v. 50 cps. A.C. mains; (b) Plug-in Wavemeter type W1053 consisting of a tuned circuit and crystal diode detector. A Muirhead slow-motion drive is used for tuning and the setting is read off against a vernier. The instrument is magnificently constructed the whole fitting into a metal outer case approx. 10 × 8 × 8in. and supplied complete with valves (4-VR91's and 1 each of VR92, 5Z4 and magic eye CV31) but without calibration chart. In new, unused condition with maker's transit case. **PRICE £4**, carriage 5/-.

ALUMINIUM CONTAINERS. Invaluable in the workshop for the storage of small parts and screws. **Holidays and picnics** for packing tooth and shaving brush, soap, tea, sugar, etc. Two sizes both with screw-on lids and 2½in. dia. Size "A" 4in. long **PRICE** 6 for 7/-. Size "B" 6¼in. long. **PRICE** 6 for **9/6**. 3 each "A" and "B" **PRICE 7/9**, or 12 your choice of sizes, **12/6**.

THERMOMETERS. Consists of a circular glass fronted dial 2in. dia. with metal temperature detection stem protuding 5in. at right angles from the back of the dial. The temperature is clearly calibrated on the face of the dial from —70° C. to +50° C. and is indicated by a rotating pointer. **PRICE 10/6**, post 9d.

3 GOLDHAWK ROAD (Dept. M.W.)
SHEPHERD'S BUSH, LONDON, W.12
Telephone : Shepherd's Bush 1729

COMPONENTS—SURPLUS AND SECONDHAND

BRAND new surplus volume controls, 1,000 ohms, long spindle, 6/6 dozen; lists free. —Bardwell & Co., Sellers St., Sheffield. [2927

WANTED, EXCHANGE, ETC.

VHF test equipment.

TS47AP, TS174, TS175/U, TS148 or TSX-48E; analysers; BC221 freq meters, TS69, and any U.S.A. test gear; Klysrons type 725/AB, 2K33 2K39 2K41; receiver, APR4 and units TN16 17-18-19; RCA AR88D, S27 and SX28s and 827CA; microwave equipment; highest offers given by return.—Ger. 8410. Universal Electronics, 27, Lisle St., Leicester Square, London, W.C.2. [0229

WANTED, receivers A.P.R.4, also T.N. 16, 17, 18, 19, etc., and any radio test gear. LESLIE DIXON & Co., 214, Queenstown Rd., Battersea, S.W.8. Macaulay 2159. [0176

WANTED, British radio test sets, Type 35 U.S.A. field strength meters, A.M. Ref. 11C8/20. STARAVIA, Blackbushe Airport, Camberley, Surrey. [2954

WANTED, Tuning units, TN17, TN18, TN19, for R54/APR4; £50 each offered.—Box 4965. [0261

STUDENT requires Avo or Taylor valve tester; must be cheap.—Write Keith Pretty, 17, Ashmead Rd., London, S.E.8. [2940

WANTED, HRO coils, Rxs, etc., A.R.88s, BR3546s, S27s, etc.—Details to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0163

WANTED, Electromecha R.C.7 twin-track tape recording panel and C.J.R. D.1 amplifier.—Secretan, Old Forys, North Lancing, Sussex. [2963

WANTED, American radio test sets, all types, including field strength meters, also British test sets Type 98.—Staravia, Blackbushe Airport, Camberley, Surrey. [2921

WANTED, set manufacturers' or ex-Government radio equipment, large or small quantities of valves, electrolytics, speakers, meters, also components. LOWE BROS., 5, Fitzroy St., London, W.1. Tel. Museum 4589. [2703

URGENTLY wanted, manuals or instruction books, data, etc., on American or British Army, Navy or Air Force radio and electrical equipment.—Harris, 95, Wardour St., W.1. Tel. Gerrard 2504. [2950

WANTED, RCA speech amplifiers, type MI-11220 J or K, and aerial tuning units BC939a.—Offers, stating quantity and price, to P.C.A. Radio, Beavor Lane, Hammersmith, W.6. Tel. Riv. 8006. [0080

WANTED, BC610 Hallicrafters, ET4336 transmitters, AR88s receivers and spare parts for above; best prices.—P.C.A. Radio, Beavor Lane, Hammersmith, W.6. Tel. Riv. 8006. [0079

WANTED, good quality communication rxs., domestic radios, test equipment, etc.; top prices paid, established since 1937.—Miller's Radio, 56a, Newgate Court, 1 min. from Leicester Sq. Tube. Tel. Ger. 4635. Call, write or send. Hours of business 10-6 p.m. Open all day Saturday. [0199

WANTED, signal generators types 30, 31, 51, 53, 54, 56 and 101; also any American test equipment with prefix TS or BC; American receivers types AR88, APR4 or similar.—Send price and details to Hatfield Instruments, Ltd., 175, Uxbridge Rd., Hanwell, W.7. Tel. Ealing 0779/9857. [0037

VALVES WANTED

ALL types valves wanted; state price and quantity, especially 813, 931A, 725A/B, etc. —Box 5768. [5014

60/- paid for 723A/Bs 45/- 813s, also required types 808, 707B, 832, etc., any quantity.—Write/tel. Pype Hayes Radio, 606, Kingsbury Rd., Birmingham, 24. Erdington 4942. [2456

BATTERIES

AMAZING battery offer!—Very large purchase of all dry HT/LT batteries enables us to make this special offer: 2 batteries 72v HT plus 1½-volt LT for 5/-, post and packing 1/6; all of recent manufacture and are tested by us for full voltage before despatch. Note—these batteries are layer built and will last for several years if properly stored. Apply now—Walton's Wireless Stores, 48, Stafford St., Wolverhampton. [0061

CONTACT LENSES

MODERN CONTACT LENS CENTRE, 7(J.1), Endsleigh Court, W.C.1. Deferred terms. Booklet sent. [0211

CABINETS

LEWIS RADIO have the best selection and finest finish.—See page 150. [0224

WALNUT radiogram cabinets; details.—Cabinetware, 1a, Heyes St., Blackburn.

WALNUT radiogram and television cabinets, soundly constructed; stamp for details.—R. Shaw 69, Fairlop Rd., Leytonstone, E.11. [2462

CABINETS made to order. Send details for quotations. Bass Reflex Cabinets, finished in period or contemporary styles. See display advertisement. Cabinets for Goodmans and other loudspeakers. (We submitted to Goodmans a Bass Reflex Cabinet, of their design, for testing, and this has been approved by them as suitable for the speaker for which it was made.) You can see your cabinet being made in our cabinet-making shop, open till 5.30 Saturdays.—A. Davies & Co. (Cabinet Makers), 3 Parkhill Place, off Parkhill Rd., Hampstead, N.W.3. Gulliver 5775. [2942

OPPORTUNITIES IN RADIO

Get this FREE Book!

'ENGINEERING OPPORTUNITIES' reveals how you can become technically qualified at home for a highly paid key-appointment in the vast Radio and Television Industry. In 144 pages of intensely interesting matter, it includes full details of our up-to-the-minute home study courses in all branches of **TELEVISION and RADIO, A.M. Brit. I.R.E., City & Guilds, Special Television, Servicing, Sound Film Projection, Short Wave, High Frequency and General Wireless Courses.**

We definitely Guarantee
"NO PASS—NO FEE"

If you're earning less than £15 a week this enlightening book is for you. Write for your copy today. It will be sent **FREE** and without obligation.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
588S COLLEGE HOUSE,
29-31, WRIGHT'S LANE,
LONDON, W.8.
BIET

STABILISED POWER UNITS
Boldre series, 100 watts, suitable for all main and service voltages and frequencies. Output stab. 150-500 volts. Impedance 1Ω. Stability .02%.

A. **Laboratory model** **£79.10.0**
B. **General purpose model** **£59.10.0**
D. **Skeleton model** for building into equip't **£44. 0.0**
(Reduced price for spot voltage or small range.)

Sub-contract wiring, assembly or potting. Inter-unit cabling made up, exact lengths.

NEWTOWN INDUSTRIES, Lymington, Hants.

EUREKA & CONSTANTAN RESISTANCE WIRES
Prices per ounce

SWG	Enam.	DASC.	SWG	Enam.	DASC.
16	1/6	1/6	28	2/1	2/6
17	1/6	1/6	29	2/2	2/6
18	1/6	1/6	30	2/2	2/6
19	1/6	1/6	31	2/3	2/8
20	1/6	1/6	32	2/3	2/9
21	1/6	1/6	33	2/4	3/-
22	1/6	1/8	34	2/6	3/-
23	1/6	1/10	35	2/8	3/3
24	1/8	2/-	36	2/9	3/6
25	1/10	2/2	37	3/-	3/9
26	2/-	2/4	38	3/3	4/3
27	2/-	2/4	40	3/6	4/9

Wires to 50 swg available

COPPER INSTRUMENT WIRE
ENAMELLED, TINNED, LITZ.
COTTON AND SILK COVERED.
All gauges available.
B.A. SCREWS, NUTS, WASHERS, soldering tags, eyelets and rivets.
EBONITE AND BAKELITE PANELS, TUFNOL ROD, PAXOLIN TYPE COIL FORMERS AND TUBES.
ALL DIAMETERS.
SEND STAMP FOR LIST. TRADE SUPPLIED.
POST RADIO SUPPLIES
33 Bourne Gardens, London, E.4

NEW G.E.C., S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS. Largest L.T. range in Great Britain. Latest Current Products. NOT Surplus.

CURRENT PRICE LIST

DEDUCT 15% FROM S.T. & C. PRICES. S.T. & C. E.H.T. K3/15, 4/5; K3/45, 6/2; K3/50, 8/8; K3/100, 14/8.

BRIDGE CONNECTED FULL WAVE. 17 v. 1.2 a., 16/4; 1.6 a., 26/-; 2.5 a., 29/-; 3 a., 30/-; 4 a., 34/6; 5 a., 37/6; all post free. 33 v. 0.7 a., 24/3; 1 a., 28/-; 1.5 a., 45/-; 2 a., 51/-; 3 a., 52/-; 4 a., 62/-; 5 a., 67/-; all post 1/-. 54 v. 1 a., 38/6; 1.5 a., 62/-; 2 a., 69/-; 3 a., 70/-; 5 a., 93/-; 72 v. 1 a., 49/-; 1.5 a., 78/-; 2 a., 81/- 3 a., 92/-; 5 a., 122/-; 100 v. 1 a., 70/-; 1.5 a., 112/-; 2 a., 128/-; 5 a., 174/-; all post 1/2.

BRIDGE CONNECTED HEAVY DUTY 7½in. SQUARE COOLING FINS. 17 v. 6 a., 49/6; 10 a., 56/-; post 1/6.

BRIDGE CONNECTED HEAVY DUTY Funnel Cooled, also 7½in. SQUARE COOLING FINS. Revised price, same both types. 17 v. 12 a., 102/-; 20 a., 118/-; 30 a., 164/-; 50 a., £12/15/-; 33 v. 6 a., 91/-; 10 a., 104/-; 12 a., 168/-; 20 a., 188/-; 54 v. 6 a., 120/-; 10 a., 142/-; 72 v. 6 a., 154/-; 10 a., 178/; 100 v., 6 a. £11; 10 a., £12/15/-; all post 1/10.

"WESTALITE" (BRIDGE). 12-15 v. D.C., 1.2 a., 15/10; 2.5 a., 27/8; 5 a., 31/9; 10 a., 54/6; 20 a., 99/6; 30 a., 144/10; 50 a., 257/-; 24 v. 1.2 a., 15/10; 2.5 a., 27/8; 5 a., 51/-; 10 a., 92/7; 20 a., 176/2; 36 v. 1.2 a., 27/8; 2.5 a., 51/-; 5 a., 69/10; 10 a., 130/9; **E.H.T. RECTS.**, 14D, 13/4, 22/-; 36 E.H.T. 60 31/10, all post extra.

Wholesale and Retail

Special Price for Quantity.

T. W. PEARCE

66 GREAT PERCY STREET, LONDON, W.C.1

Off Pentonville Rd. Between King's Cross and Angel

BENSON'S BETTER BARGAINS

METERS. New, boxed. **M.C.** 2½in. Fl. rd., 130 v., (1 m/a. F.S.D.). Rec., **15/6**; 10 m/a., 20 m/a., 100 m/a., 200 m/a., 300 m/a., **M.I.** 15 v., 30 a. Proj. T.C. 1 a. **M.C.** 50a. All at 8/- each. 2in. sq. **M.C.** 6 m/a., 100 m/a., T.C. 3 a. at 7/- each. 2in. Rd. Proj. M.C. 30 m/a., 7/-. 50A 6in. M.I., Fro., Metal case, 30/-. 2½in. Fl. rd. met. 6 m/a. TC (500ua. F.S.D.) **17/6**. 3½in. 3,500 v. M.C. Proj. 10/-. 2in. sq. 6, 20 v. M.C., 8/6. 6in. proj. met. 250 v. 500 cycles M.I., **17/6**.

M1155, slow motion drives, **7/6**; I.F. Filter, **2/6**. **T.V. Pre-amps.**, with 1/VR136, 7/-; with 2 VR91, **17/6**. Trans. Input 110/240 v. Outputs 550-0-350 120 m/a. 6.3 v. 4 a., 4 v. 2 a., new **16/6**. **Metal Rectifiers.** HW 270 v. 80 m/a., 6/-; 480 v. 80 m/a., 600 v. 30 m/a., **6/6**; HW CT 12 v. ½ a., **1/6**. **CONDENSERS** 15 kVw ceramic, 1 each 500 pF and 750 pF, in case, 5/-.

DYNAMOTORS, soiled cases, D.C. (approx. 230 v. 80 m/a., at 6 v.), **8/6**. 24 v. to 250 v. 100 m/a. (twice), **17/6**; 12 v. to 250 v. cased, **17/6**; uncased **12/6**. Filters for these, **2/6**. **RELAY** 12 v. actuating toothed bakelite wheel, **2/6**. **R3170A.** 150/200 mc/s. 14 valves. Brand new, 75/- (carr. 7/6). **WAVEMETERS**, new, 3/VR92, 3/VR136, 1/6J5, 140/250 mc/s. (less meter), 30/-. 230 v. input, power pack for this **22/6**. (Carr. 2/4).

I.F.T.s, new, canned 7 mc/s. (R1355) or 10/15 mc/s., **1/6**. **R.F. UNITS** type 24, 15/-; 25 **17/6**; 26 **35/-**; 27 **35/-**; (26 and 27 with broken dials, **30/-**). Universal Avometer, replacement front panels, **7/6**. **CHOKES** LF 9H 100 m/a. **7/6**; 3H 200 m/a. **4/6**; 50H 20 m/a. **4/6**. **ROTER GENERATORS**, new, with valves, 4/VR65, 1/6V6G, 1/CV172, **30/-** (carr. 5/-).

POTENTIOMETERS. 3in. dia. 20 k. 10 w. **3/-**. Preset carbon, 1/3, spindled **1/6**, with S.P. switch **2/9**; most values. **Record Players**, new (famous maker), 33⅓ r.p.m., Xtal P.U., **79/6**. **R.F. Chokes**, multi-pie, Rx type **9d**. Tx **1/-**. **Condensers**, midget, 6 mfd. 450 v.w. **1/9**, 8-8 **3/9**, 16-16 **4/6**, 2 mfd. **1/3**; 8 500 v. paper, **2/6**, 0.5 2.5 kV. **3/6**, 4 750 v.w. **3/-**. **Variable**, min. spindled, 15, 25, 50, 75 pfs. **1/3**, 20 pf preset **1/-**. Bowden cable, with outer, 9ft. **3/6**. G.P.O. Jacks, **6d**. Jackplugs on 16ft. 'phone cord, **2/6**. Mics. Carbon, hand, 5/6. D.L.R. 'phones, **8/6** pr.

POWER UNIT 250, New, 230v. input, Outputs, 2,000v., 350v., 6.3v., **77/6** carr. paid.

List and enquiries, S.A.E. please!

Terms: Cash with order. Postage extra. Immediate despatch.

Callers and Post	Callers only
W. A. BENSON (WW), 308 Rathbone Rd., Liverpool 13, STO 1404	SUPERADIO (Whitechapel) LTD., 116 Whitechapel, Liverpool, 1 ROY 1139

CABINETS

ATTRACTIVE serviceable cabinets, 6×4×3in. for crystal sets, test meters, etc, 4/6 pp., other sizes available; s.a.e., photo.—T. Wilkinson, 42, Frances Rd., Windsor, Berks. [5025

REPAIRS AND SERVICE

MAINS transformers rewound, new transformers to any specifications.
MOTOR rewinds and complete overhauls; first-class workmanship; fully guaranteed.
F.M. ELECTRIC Co., Ltd., Potters Bldgs., Warser Gate, Nottingham. Est. 1917. Tel. 47898. [0115

AISH & Co., Ltd., Vanguard Works, Poole, Dorset.
MAINS transformers, E.H.T.s, line outputs, frame transformers, chokes, fields, solenoids, etc., copy rewound or to specification; all types vacuum impregnated.
NEW transformers manufactured to your specific requirements, including the "C" core range of quality transformers and chokes.
TOROIDAL coil winding capacity available.
YOUR enquiries will receive prompt attention when addressed to:
AISH & Co., Ltd. (Transformer Dept.), Vanguard Works, Poole, Dorset. [2613

LOUDSPEAKERS repaired promptly.—Model Loudspeaker Service, Bullingdon Rd., Oxford. [2837

SERVICE sheets, hire, sale; valve list, including obsolete types, 5d.—Gilbert, 24, Frithville Gdns., London, W.12. S.a.e. enquiries. [2920

SERVICE sheets for hire or sale, over 2,000 models, radio and television; s.a.e. enquiries.—W. Gilbert, 24, Frithville Gardens, London, W.12. [2874

TRANSFORMER rewind service, mains, E.H.T. transformers and chokes, prompt delivery, range of replacement types ex-stock or manufactured to your specification.
METROPOLITAN RADIO SERVICE Co., 75, Kilburn Lane, London, W.10. Ladbroke 2296. [0200

MAINS transformers, E.H.T. line outputs, chokes and field coils, etc., promptly and efficiently rewound or manufactured to any specification; 12 months' guarantee.
LADBROKE REWIND SERVICE, Ltd., 820a, Harrow Rd., Kensal Rise, N.W.10. Lad. 0914. [0222

ELECTRICAL test instruments repaired and standardised, all types British or American, ammeters, voltmeters, ohmmeters, DC/AC multi-range meters, etc.; meters converted to specification.
THE ELECTRICAL INSTRUMENT REPAIR SERVICE, 329, Kilburn Lane, London, W.9. Tel. Lad. 4168. [2821

VAC armatures rewound, 15/- each, fully guaranteed; speedy delivery; drills, fractional motors also rewound at competitive prices; details.—K. B., 6, Mitchells Cres., Penydarren, Merthyr Tydfil. [2975

AUDIO Equipment repaired/rebuilt or modified, disk or tape recorders/amplifiers/sound projectors, quotations without obligation, extended payments available above £15.—Bernard J. Brown, 33, Goldhawk Rd., London, W.12. [0025

24-HOUR service, 6 months' guarantee, any transformer; rewind, mains outputs and i.f.s., etc.; all types of new trans., etc., supplied to specification; business heading or service card for trade prices.—Majestic Winding Co., 180, Windham Rd., Bournemouth. [2526

REWINDS and conversions to mains and output trans, pick-ups, fields, clock coils, etc., from 4/6; PP equipment a speciality; all work guaranteed.—N.L. Rewinds, 173, High Rd., Willesden Green, N.W.10. Tel. Wordsworth 7791. [2364

ARMATURE rewinding service to the trade, vacuums, drills, grinders, hood dryers, dental motors, vacuum cleaner armatures replaced from stock, 24 hours service; every job guaranteed; we also specialise in complete overhauls and rebuilds of vacuum cleaners; all vacuum cleaner parts, hoses, bearings, fans, brushes, for any make in stock.—Regam Electric 95, Park Lane, Leeds, 1. [0028

AS professional sound recordists and members of the Association of Professional Recording Studios, we are particularly well qualified to give advice and service on all aspects of sound recording and reproduction. Design of tape equipment a speciality. Circuits designed, repairs and modifications carried out quickly. Advice freely given. See also below:—
COMPREHENSIVE service to trade and amateur; design, manufacture and repair of electronic equipment carried out by specialists; equal attention given to small or large orders. See also below:—Autochangers, 48-hour service, cleaning and adjusting at fixed price of 45/- plus carriage; also all repairs carried out; trade enquiries invited; callers by appointment only please.—Ariel Sound, 57, Lancaster Mews, London, W.2. Tel. Paddington 5092 (2 lines). [0026

PAINTS, CELLULOSE, ETC.

PAINT spraying handbook, 3/6 post free, cellulose and synthetic paints and all spraying requisites supplied; catalogues free.—Leonard Brooks, 53, Harold Wood, Romford. [0207

BUSINESS AND PROPERTY

RADIO and TV sales and service business in W. Midland market town; good agencies; turnover approx. £5,000 p.a.; shop, house, garden, garage; freehold, £3,000; s.a.v.—Box 5775. [3019

RADIO and TV servicing workshop (Trade and Public); elect. installation contractor; 6 years estab. retailing and wholesaling; going concern, S.W.1; £800 plus s.a.v.—Box 4520. [5006

"I hope," said one of our customers, after giving us a more lavish amount of praise than usual, "that this letter will not induce you to lower your standards on the grounds that your transformers are too good and last too long."

A swelled head is not one of our afflictions, and the compliments have precisely the opposite effect.

SAVAGE TRANSFORMERS DEVIZES LIMITED

Nursteed Road, Devizes, Wilts.

Tel.: Devizes 536

Most types of coil winding undertaken. Very quick deliveries, small or large quantities. Transformers, Chokes, Solenoids, Relay Coils, etc., wound on your own bobbins or formers for your own assembly. Impregnating (varnish) on all work done if required. Best quality material used. Single prototypes made to high standards, regulation and cool running, etc.

FOR CATHODE RAY TUBE FAILURES. Special low capacity secondary winding for Heater/Cathode shorts to restore picture after this fault has occurred. All Primaries tapped, framed and tag panelled. 200/250, 2 v. at 2 a., 4 v. at 2 a., 6.3 v. at 2 a., 10.8 v. at 0.3 a., at 29/6 each.
(Discount to trade)

EMISSION REJUVENATORS. 200/250 tapped output tapped in steps. 2 v. to 2½ v. to 2½ v. at 2 a., at 38/6 each.
Output 200/250 tapped in steps 6.3 v. to 7 v. to 8 v. up to 9½ v. at 2 a., at 37/6 each.
(Discount to trade)
Both space wound for Heater/Cathode shorts also

T.V. HEATER TRANSFORMERS. 200/250 6.3 v. at 7 a., 0-2-6.3 v. at 2 a., at 19/6 net.

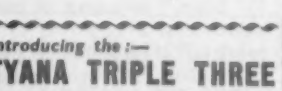
T.V. AUTO TRANSFORMERS. 0-190-210-230-240 at 6.3 v. at 7 a., 0-2-6.3 v. at 2 a., at 27/6 net.

T.V. FRAME TRANSFORMER. 60 H. magnetic deflection, suitable for most home constructed sets at 15/6 net.

FULLY SHROUDED. 200/250 input, 350/0/350 v. at 150 mA., 6.3 v. 5 a., 5 v. 3 a. 49/6 nett.

NORTHERN TRANSFORMER CO.
215 BARKEREND ROAD
BRADFORD, YORKS

TR1154/55 RECTIFIERS
Input :—200/250v., 50~S.P. Output :—6.3v., 13A.—220v., 110m.a.—1200v., 200ma.
NEW CONDITION—TESTED—GUARANTEED
£17-10-0 per set Carriage extra.
A. J. WHITTEMORE (Aeradio) LTD.
Croydon Airport, Surrey Tel: Croydon 2761, 4033, 7764 Grams: Aeradio, Croydon.

Introducing the :—
TYANA TRIPLE THREE

Reg. Design. No. 867884
MAKE SOLDERING A PLEASURE
SMALL SOLDERING IRON
Complete with detachable BENCH STAND **19/6**
The smallest high-power soldering iron. Length only 8½in.; adjustable long bit dia. 3/16; mains voltages 100/110, 200/220, 230/250.
The "STANDARD"
Popular Soldering Iron

now reduced to 14/11
Replacement Elements and Bits for both types always available.
KENROY LIMITED
182/197 UPPER ST., ISLINGTON, LONDON, N.1.
Telephone : Canonbury 4905-4663

BUSINESS OPPORTUNITIES

OLD-ESTABLISHED firm of exporters in the electronic field, invite manufacturers seeking overseas sales to communicate Box 0259.

FOR sale, name and goodwill (4 years display advertising in "Wireless World") of radio business; suit enthusiasts; £250.—Box 5626. [2962

GENUINE offer for Radio/TV engineer with ambitions, stock data, equip., transport, 'phone workshop and clients; £200; help given. N.W. dist.; reason sale age.—Box 5556. [2945

WORK WANTED

ASSEMBLY, wiring of all types of electronic equipt., control panels, switchboards, etc.—R.A.E., 377, High Rd., London, N.2. [0219

AID approved contractors for machining, assembly coilwinding, speciality, distrene work, and toroidal winding.—Bel Bound Products Co., Marlborough Yard, N.19. [0183

ELECTRONIC sub-contracts and prototypes; modern miniature technique, exp. government work, skilled labour only.—Astra Radio and Television, Electra House Haslemere, Surrey. Tel Haslemere 1134 [2635

MACHINERY FOR SALE

TRANSFORMERS, Metrovick, oil filled, 230/18,000v, 4kva., 50 cycles, brand new ex-Govt surplus; to clear £15 each, plus 17/6 carriage; or invite offers for 200 lot.—Wireless Instruments (Leeds), Ltd., 54-56, The Headrow, Leeds, 1. Tel 22262. [2982

MISCELLANEOUS

COIL winding machines; from £15.—Hawkins, 170, Witton Rd., Birmingham, 6. [2879

FREE list; sensational prices; valves, components.—Jack Porter, Ltd., College St., Worcester. [2974

DURALUMIN rod, ½in dia., in length up to 5ft 6d per foot; min. orders 15ft; carriage extra.—Estlo Trading Co., Bangor, Caerns. [3018

METALWORK, all types cabinets, chassis, racks, etc., to your own specifications; capacity available for small milling and capstan work up to 1in bar.
PHILPOTT'S METAL WORKS, Ltd. (G4B1), Chapman St., Loughborough. [0206

GESTETNER (hand) rotary duplicator, Ream model, oak cabinet on metal legs, many accessories, perfect condition; £17/10.—Box 5710. [2986

YOUR own tape recording transferred to disc.—Write, call or 'phone Queensway Private Recording Studios, 123, Queensway, W.2. Tel Bay. 4902. Studio recordings, tape recording service. [2507

PLYWOOD—Hardboards. Send s.a.e. for free price lists and samples, including ⅛in mahogany ply 10d sq ft, sheets 72in×36in; hardboard all sizes, from 6d sq ft; free delivery (100 miles).—N. Gerver, 2-10, Mare St., London, E.8. Amherst 5806. [0027

ENGRAVING amateurs and trade could take the opportunity of engraving problems in the future by getting in touch with A.G. Engraving, 19a, Windmill Rd., London, S.W.18. Bat. 5703. Brass, bronze, erinoid, Perspex dials; one knob or repetition equally entertained. [0034

COPPER wires enamelled, tinned, Litz, cotton, silk covered, all gauges; B.A. screws, nuts, washers, soldering tags, eyelets, ebonite and laminated bakelite panels, tubes, coil formers; Tufnol rod, headphones, flexes, etc.; latest radio publications, full range available; list, s.a.e.; trade supplied.—Post Radio Supplies, 33, Bourne Gardens, London, E.4. [0138

YOUR tapes to disk (78 & L.P. Microgroove, genuine), tape, disks, accessories; trade terms on above; E.M.I. & Ferrograph Recorders; studio and mobile service, professional standards, "Eroica" Recording Services (Regd. 1949), Peel St., Eccles, Manchester, Eccles 1624, Musical Director Thurlow Smith, A.R.M.C.M. [0121

NOTICES

HI-FI demonstrations at Electronics Exhibition, Manchester, 14th-20th July, by H. & H.—Free admission, tickets only (s.a.e.), from Holiday & Hemmerdinger, Ltd., 74, Hardman St., Manchester, 3. [3005

BRITISH SOUND RECORDING ASSOCIATION. Details of membership, open to the professional sound recording engineer and all others interested in recording high quality reproduction and other branches of audio engineering, together with details of the London lecture programme and the Manchester, Portsmouth and Cardiff Centres, may be obtained from the Hon. Membership Secretary, H. J. Hougate, A.M.I.E.E., 12, Strongbow Rd., Eltham, S.E.9. [0031

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

KENT EDUCATION COMMITTEE.
MEDWAY College of Technology.
RADIO technician required for maintenance of receivers and test gear and for construction of prototype apparatus.
SALARY £350 to £410 according to age and experience.
APPLY by letter stating age, qualifications and experience, to the Principal, Medway College of Technology, Horsted, Maidstone Rd., Chatham. [2972

FINISHED BUILDING THAT CHASSIS?
Why not have the cabinet made to your own specification!
Send sketch and full details—we will quote by return. Or send 1/- for our latest illustrated catalogue of T/V, Radiogram, Table, Corner Baffle Cabinets, etc., in all of which the radio panel, motor and baffle boards may be cut to suit your own requirements.
Components
We hold extensive stocks of Radio and T/V components. No list available.
Chassis
Send for free leaflet on our latest 5 valve, 3 waveband superhet radiogram chassis.
Amplifiers
Send for details of our domestic 4½ and 5 watt amplifiers.
Tape Recorders
The latest 2-speed "ELIZABETHAN" model available at 48 gns. Send for details.
LEWIS RADIO CO.
Dept. 754, 120, Green Lanes, Palmers Green, London, N.13
Tel.: BOWes Park 6064

MALVYN ENGINEERING WORKS
Precision Engineers
Manufacturers of: Chassis, Small Pressings, Machined Components, Wiring and Mechanical Assemblies to specification.
Single and Production Quantities. Enquiries Invited.
100 PARK ROAD, WARE, HERTS.
Telephone: Ware 465

SAMSON'S SURPLUS STORES
30ft. AERIAL MASTS, TYPE 85. Comprising 9 ashwood sections and 1 metal mast top section with aerial clamp attachment. Complete with base plate, guys and rings. Dia. of first section 1¼in. Dia. of top section ¼in. Supplied new in maker's transit cases with instructions, 65/-, carr. 5/-.
12in. COPPER-PLATED AERIAL RODS. Push-in sleeve joint, 8/6 per half gross; 15/- per gross; £2 per 1,000, plus carr. These rods are very useful to gardeners and farmers.
AMAZING OFFER—MINIATURE ACCUMULATORS, by Willard Co. 36 v. 9.3 amp. Size 3½×1½×4in. Weight 5½ oz., 5/-, P.P. 6d. 6 v. 1.8 amp. Size 2½×1½×4in. Weight 4½ oz., 7/6, P.P. 6d. Or set of three 36 v. and one 6 v. in sealed container, £1, P.P. 1/3. Brand new and uncharged. Easily filled with hypodermic syringe.
BRAND NEW EX-ARMY MEDICAL HYPODERMIC SYRINGES. 1 c.c., complete with needle, 4/9, P.P. 6d. 10 c.c., with needle, 7/6, P.P. 6d. Extra needles 5 for 2/-, P.P. 6d.
BRAND NEW A.M. METERS. All by famous makers. 0-500, 0-100, 0-20 mA., 2½in. D.C.M.C. panel mounting, 15/-, P.P. 1/-. 500-0-500 microamp blank scale 2½in. panel mounting, 25/-, P.P. 1/-. 20-0-20 amps. 2in. sq. D.C.M.C. panel mounting, 9/6, P.P. 1/-. Master Voltmeter, 0-30 v., A.C. 50 cy. M.I. 6in. mirrored scale, 27/6, P.P. 1/6.
169/171 Edgware Road
London, W.2. Tel.: PAD 7851
125 Tottenham Court Road, W.1.
Tel.: EUS 4982
All orders and enquiries to our Edgware Road branch, please. This is open all day Saturday

THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKISTS OF BRITISH and AMERICAN TECHNICAL BOOKS

Television Receiver Servicing: Vol. I—Time-Base Circuits by E. A. W. Spreadbury. 21s. 0d. Postage 9d.

The Oscilloscope at Work by A. Haas and R. W. Hallows. 15s. 0d. Postage 6d.

The Radio Amateur's Handbook: 1954 by "A.R.R.L." 30s. 0d. Postage 1s.

The Amplification and Distribution of Sound by A. E. Greenlees. 35s. 0d. Postage 9d.

A Text-Book of Radar edited by E. G. Bowen. 45s. 0d. Postage 1s.

Magnetic Amplifier Circuits by W. A. Geyger. 42s. 6d. Postage 1s.

Reference Data for Radio Engineers by Fed. Telephone & Radio Co. 37s. 6d. Postage 1s.

Basic Electronic Test Instruments by R. P. Turner. 32s. 0d. Postage 1s.

Radio Designer's Handbook by F. Langford-Smith. 42s. 0d. Postage 1s.

Foundations of Wireless by M. G. Scroggie. 12s. 6d. Postage 9d.

Television Test Equipment by E. N. Bradley. 5s. 6d. Postage 3d.

Handbook of Line Communication: Vol. I by The Royal Signals. 30s. 0d. Postage 1s. 3d.

Radio Valve Data compiled by "Wireless World." 3s. 6d. Postage 3d.

19-23 PRAED STREET
LONDON, W.2

(Dept. W.7)

Please write or call for our catalogue.

Phone: PADdington 4185.

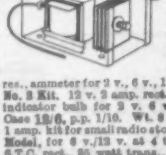
Open all day Saturday.

"AUTOMAT" CHARGERS and D.C. from A.C. POWER PACKS

as supplied to Ministries, Airline Co's. etc, all voltages and up to 350 watts output. Correct design, best materials and workmanship. Selenium Rectifier Stacks, S.T.C., Westalite, G.E.C. etc. 40 ma to 10 amp, 2v to 400v, H.W., Bridge, Centre Tap.

STANDARD CHARGERS. Truck battery booster compact, automatic semi constant voltage battery charger specially designed to keep truck, car or tractor batteries fully charged, operates on A.C. 220/240 v. line, damp-proof, ultra reliable. 6 v./12 v. model output 5 amp. weight 15 lbs. 22/5/-, carr. 2/-. Ditto 24 v./12 v. £11/10/-. 12 v. 3 amp., 65/-, carr. 2/3. Ditto, 6 v. 3 a./12 v. 2 a. 65/-, also original 6 v./12 v. 2 amp., 59/6, p.p. 2/-. Wt. 8 lb.

POOLPROOF CHARGER KITS. Genuinely trouble free and ultra reliable. As sold for 11 years through "W.W." with full data sheet and instructions.



No 1 Kit (as illust.) Westalite 3 amp. rectifier, 65 watt tapped, impregnated trans., ballast bulb, for 2 v., 6 v., 12 v. charger, all rectifier trankies eliminated, 46/-, p.p. 1/10. Handsome steel case, ready punched, louvred, enamelled, 12/6. **No 1A Kit.** 3 a. rectifier, 65 watt trans., ballast res., ammeter for 2 v., 6 v., 12 v., 3 a., 52/6, p.p. 1/10. **No. 2 Kit.** 12 v. 3 amp. rect., 48 watt trans., ballast/indicator bulb for 2 v. 6 v., 12 v. charger, 38/6. Case 10/6, p.p. 1/10. Wt. 9 lb. W. case. 4 to 26 cell 1 amp. kit for small radio store, 78/6, p.p. 2/-. **Senior Model,** for 6 v./12 v. as 4 to 8 amp., 12 v. 5 amp. S.T.C. rect., 85 watt trans., ballast bulb, 64/-, p.p. 2/-. **Slider Kit,** 120 watt trans., 14 v. 6 amp., large finned type rect., slider res., high grade ammeter, wt. 17 lb., for 6 v./12 v. charger, £4/13/-, carr. 4/-.

SELENIUM RECTIFIERS, new stock not surplus, best makes. 12/15 v. 3.4 amp., 15/6, p.p. 9d., 24 v. 3 amp., 27/6, 24 v. 0.3 amp., 9/6, 24 v. 1.5 amp., 15/6, p.p. 9d. 6 v. 4 amp., 15/6, 12/14 v. 6 amp., large finned type, 32/-, p.p. 1/-, 24 v. 5 amp., 57/-, Small space h.t. rects., 250 v. 60 m/a., 7/6, 250 v. 100 m/a. bridge, 14/6, p.p. 6d., miniature 200 v. 20 m/a., 7/6, 230 v. 200 m/a. bridge, 22/-. Many others, h.t. and l.t., with or without transformer.

"RENEWBAT." Battery desulphator and conditioner 1/9, post 3d. Car size 2/-, post 4d.

CHAMPION PRODUCTS
41, Uplands Way, LONDON, N.21. Phone LAB 4457

SITUATIONS VACANT

GUIDED weapons.

THE Guided Weapons Department of Vickers-Armstrongs, Ltd., Weybridge, has vacancies for the following staff:—

GRADUATE engineers, with degrees in engineering, physics or mathematics, and 3 to 5 years' experience in one of the following categories:—

E.1. DESIGN and development of high pressure hydraulic or pneumatic systems and components.

E.2. DEVELOPMENT of techniques for vibration and/or climatic testing as applied to electronic equipment and design of associated test gear.

E.3. DEVELOPMENT work on reinforced plastics.

E.4. DESIGN of missile autopilots, simulators and computors.

E.5. DESIGN of U.H.F. and micro-wave transmitters and receivers.

E.6. DESIGN of transformers and magnetic amplifiers, with good general knowledge of electrical properties of materials.

E.7. DESIGN of electronic circuits and servo mechanisms.

E.8. ENGINEERING development of missile electronic equipments.

TECHNICAL assistants, with degree, Higher National Certificate or equivalent, and experience in one of the following categories:—

T.1. DEVELOPMENT and test of high pressure hydraulic or pneumatic systems and components.

T.2. ENVIRONMENTAL testing of missile components.

T.3. MANUFACTURE of prototype missile electronic equipments to M.o.S. specifications.

T.4. MANUFACTURE of reinforced plastic components and potting of electronics.

T.5. DEVELOPMENT and test of instrumentation for missile trials.

T.6. DEVELOPMENT of missile autopilots and analogue computers.

LABORATORY assistants, preferably with O.N.C. or equivalent.

L.1. ASSEMBLY, test and maintenance of hydraulic and pneumatic systems and components.

L.2. DRAWING and constructing test rigs used for mechanical and environmental testing.

L.3. MANUFACTURE of prototype electronic equipment and electro-mechanical devices. Layout and wiring from circuit diagrams and sketches, chassis work and simple machining.

DRAUGHTSMEN, with 2 years' experience or more, as follows:—

D.1. DESIGN of ground, airborne or missile types of radar equipment.

D.2. DESIGN of small mechanisms such as missile autopilots, and electro-mechanical computors embodying gyroscopes, accelerometers, small motors, gear boxes, etc.

APPLY to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Division), Weybridge, Surrey, giving full particulars and quoting reference EO/G.W./reference number above.

WEYBRIDGE station is 30 minutes from London on the main Waterloo/Portsmouth line. ADDITIONAL buses operate to and from the works at starting and finishing times. CANTEEN facilities. [2996

CITY OF LIVERPOOL
EDUCATION COMMITTEE.

RIVERSDALE Technical College, Riversdale Rd., Liverpool, 19.

PRINCIPAL: A. R. Kinsman, B.Sc.(Eng.), A.M.I.Mech.E., A.M.I.E.E.

APPLICATIONS are invited for the appt. of two Assistants (Grade A). Duties to commence Sept., 1954.

SALARY: £415×£18—£670 p.a., plus allowances for training and graduation. Increments allowed for industrial experience and War Service. (Burnham Tech. Award.)

APPLICANTS must have seagoing experience and possess a good knowledge of technical electricity, to teach mainly radio telegraphy and procedure to students preparing for the P.M.G. Certificate Examinations.

THEY should possess the P.M.G. First Class Certificate and have had recent operating experience.

APPLICATION forms (and further particulars) obtainable from R. S. Magnay, M.A., Director of Education, 14, Sir Thomas St., Liverpool, 1, should be returned to him within two weeks of the appearance of this advertisement.

THOMAS Alker, Town Clerk and Clerk to the Local Education Authority. (JA.3563). [2948

RADIO and Television Engineers.

FIRST-class openings for an experienced Car Radio Engineer, Television Engineers and Senior Design Draughtsmen will shortly become available with a firm of repute in the London area.

ENGINEERS able to undertake immediately development work on Broadcast Radio and Television Apparatus would be offered an attractive salary.

THE successful candidates will be eligible for Company Superannuation and Insurance schemes.

PLEASE reply, giving full details of experience, to Box 3289. [2917

HIGH Voltage Insulation Engineer.

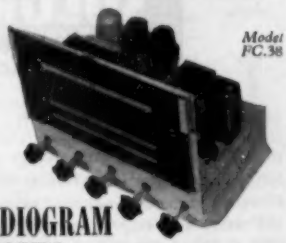
THE ENGLISH ELECTRIC Co., Ltd., at Stafford have a vacancy for an engineer preferably with post-graduate experience in high-voltage engineering, to undertake investigations and development work in high-voltage insulation.—Applications should be submitted to the Chief Insulation Engineer, Dept. C.P.S., 356-7, Strand, W.C.2, quoting Ref. 1329. [3032

FOR OVER 20 YEARS THERE HAS BEEN AND STILL IS ONLY ONE

Armstrong

Specialists in the manufacture of the

HIGHEST QUALITY CHASSIS



Model FC.38

RADIOGRAM CHASSIS We have a comprehensive range of superb Chassis ranging from 8 valve superheterodyne to a 15 valve Band-spread receiver. The three most popular models, universally acclaimed are :—

FC.38 — 8 valve — all-wave — **Price £23/13/- (inc. tax).**

RF.41—10valve — all-wave — **Price £31/19/8 (inc. tax).**

EXP 125/A — 14 valve — all-wave — **Price £48/19/5 (inc. tax).**

RADIOGRAMS As introduced in March our "Special" Radiogram is now much in demand. This superbly-cabineted receiver incorporates the magnificent FC.38 Chassis, the very latest 3 speed intermixing Record Changer and a High Flux 10in. P.M. Loudspeaker.

"Special" Radiogram Price 79 Gns. (inc. tax).

TELEVISION

The TV.5 Range is available in many forms and incorporates all the most up-to-date improvements such as 5-channel selector switching and aluminised flat faced tube and tinted filter.

★ **PROVISION IS NOW MADE FOR A 13-CHANNEL ADAPTOR, WHICH WILL BE AVAILABLE AT A NOMINAL CHARGE WHEN REQUIRED.**

The TV.5 Range really gives the TRUE BLACK AND WHITE PICTURE.

TV.5 14in. Chassis, £54/-/3 (inc. P.T.).
TV.5 14in. Table Model, £61/19/- (inc. P.T.).
TV.5 14in. Console, £72/9/- (inc. P.T.).
TV.5 17in. Chassis, £64/15/11 (inc. P.T.).
TV.5 17in. Console, £82/19/- (inc. P.T.).

★ **SEE PAGE 64 FOR DETAILS OF OUR NEW AMPLIFIER** ★

Our Showroom at the address shown below is open daily from 9 a.m. to 6 p.m. (Saturdays 5 p.m.) and we are always delighted to demonstrate any of our Models or supply any information regarding them. If unable to visit us please send for the specifications you may require.

ARMSTRONG WIRELESS & TELEVISION CO. LTD.
WARLTERS ROAD, HOLLOWAY, LONDON, N.7
Telephone: NORth 3213/4

Switch on to

HENLEY SOLON ELECTRIC SOLDERING IRONS

Solons save time, reduce costs. Solon soldering is always clean, reliable and simple. Five models, in voltage range 100-250; each with 6 feet Henley flexible. 65 watt; oval tapered or round pencil bits. 125 watt; oval tapered or round pencil bits. 240 watts; oval tapered bit.

Write for Folder Y.10

W. T. HENLEY'S Telegraph Works Co. Ltd., 51-53 Hatton Garden, London, E.C.1

MORSE CODE Training

COURSES for BEGINNERS and OPERATORS, also a SPECIAL COURSE for passing the G.P.O. Morse Test for securing an AMATEUR'S TRANSMITTING LICENCE.

Send for the Candler BOOK OF FACTS

It gives details of all Courses

Fees are reasonable.

Terms: Cash or Monthly Payments.

THE CANDLER SYSTEM CO. (S.W.) 52b ABINGDON RD., KENSINGTON, LONDON, W.8

Candler System Co., Denver, Colorado, U.S.A.

FIRE!

AT 25, PICCADILLY, W.1

NU-SWIFT!

Not yet visited the new Nu-Swift Fire Protection Centre? Call when you're next in the West End. You'll be very welcome!

Nu-Swift Ltd., 25 Piccadilly, W.1. REGent 5724

In Every Ship of the Royal Navy

SITUATIONS VACANT

ENGINEER required to take charge of ENGINEERING Department of Factory manufacturing Quartz Crystals. University Degree and some experience of industrial or service electronic equipment essential. Rudimentary knowledge of chemistry an advantage. Reference E.

ENGINEER required in Development Laboratory engaged in frequency control systems. Combined knowledge of physics, mathematics and electronics required, and ability to work alone from fundamental ideas. Honours degree in physics necessary, and preferably some experience of industrial electronics an advantage. Reference D.

HOUSES can be made available to successful applicants in both vacancies.

APPLY in writing quoting reference letter, to PERSONNEL Manager, Standard Telephones & Cables, Ltd., Crystal Factory, Industrial Estate East, Harlow, Essex. [2905

FAULT finders and testers.

A LARGE electronic engineering company invite applications from

FAULT Finders

POSSESSING a good technical background of V.H.F. transmitter receivers employing frequency control, automatic modulation, A.G.C. automatic frequency systems. Knowledge of M.O.S. inspection procedure and requirements an advantage.

RATES of pay ranging from 4s 2d to 4s 11d per hour according to qualifications and experience.

APPLICATIONS are also invited from

SKILLED electronic wiremen and

ELECTRO-Mechanical instrument makers.

EAST London area.—Please reply, giving full details of experience, to Box 5542. [2944

WIRELESS Station Superintendent required by the

GOLD Coast Government Posts and telecommunications Department for two tours of 18 to 24 months in the first instance. Salary, etc., according to qualifications and experience in consolidated scale £990 rising to £1,250 a year, with gratuity of up to £150 a year. Outfit allowance £60. Liberal leave on full salary. Free passages. Candidates should possess a Higher National Certificate or equivalent, and have had practical experience in two or more of the following fields: V.H.F. link systems; H.F. communication network; frequency shift keying and teleprinter maintenance; V.H.F. and H.F. direction finding systems; aeronautical navigation aids (ground); manufacture of light engineering equipment. Candidates from the British Post Office should apply through departmental channels.—Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/29100/WF. [2980

E. K. COLE, Ltd. (Malmesbury Division):

THE Malmesbury Division of E. K. Cole, Ltd., is engaged in the development and production of radar and communication equipment associated with high priority defence projects. Vacancies exist in the Development Department for project engineers, engineers and assistant engineers with training and experience in the following fields:—

PULSE circuits.

Pulse modulators, strobe systems, Video amplifiers, time base generators, etc.

MICROWAVE technique.

Aerial design for radar scanners and waveguide components for high power T/R units H.F. and V.H.F. Communication.

Airborne and ground receivers, transmitters and aerial systems.

TRANSFORMER design.

High frequency power transformers for airborne equipment.

MECHANICAL engineering.

Light mechanisms and structures for radar scanners.

APPLICANTS should have had technical training to Degree or Higher National Certificate standard, and in the case of project engineers and engineers appropriate technical design experience is necessary. Commencing salaries will be dependent on qualifications and experience, and will compare favourably with scales prevailing in the radio industry. Housing accommodation may be available in the near future for successful married applicants. A superannuation scheme is in operation, together with canteen and full welfare facilities. Applicants should apply in the first instance for a technical staff application form to Personnel Manager, E. K. Cole, Ltd., Malmesbury, Wilts. [2792

MOUNT VERNON HOSPITAL, Northwood, Middx

TECHNICIAN, with experience in electronics and workshop practice, required for the physics department; a first-hand knowledge of microwave and/or pulse circuit techniques would be an advantage; salary within the scale £450×£15 (3)×£20 (1)—£515 p.a. plus London weighting; N.H.S. superannuation scheme.—Applications to the Secretary and House Governor as soon as possible. [2971

ELECTRICIANS are required for work on industrial electronic equipment by the Steel Company of Wales, Ltd., Port Talbot.

APPLICANTS should have previous experience and/or good technical background as basis for period of training.

THOSE wishing to apply should write, giving full particulars of age, experience, qualifications, etc., to the

PERSONNEL Superintendent, The Steel Company of Wales, Ltd., P.O. Box No. 3, Port Talbot, Glam. [3030

SPECIAL OFFERS

INSTRUMENT RECTIFIERS. 5 milliamp., 7/6 ea. 50 mA., 5/- ea.

AUTO TRANSFORMERS. 230/115 volts, 200 watts, 50 cy. fully shrouded. New, METVIC, 90/- each.

MICROPHONES, T.50. Moving coil, complete with 2 pole plug and cable as used with the well known American Hallicrafters. 30/- ea.

BALL DRIVES. Epicyclic friction, type 5 to 1, 2/6 ea.

CAPILLARY TUBING. 250ft. coils 6AA/1473 Cambridge Inst. Co., 25/- per coil.

ELECTRO MAGNETIC COUNTERS. Post Office type counting up to 9,999 operating from 1½ volts D.C. Coil resistance 3 ohms, overall size 4¾ × 1¾ × 1¾, perfect condition, 12/6 each, post 1/-.

ALKLUM LONG LIFE BATTERIES. 12 volt input, consisting of 10 cells in crate, each cell is 1.2 volt 45 A.H. Price complete, uncharged, £10. Carr. 10/-.

TELEPHONES. For intercommunication between 2 or more positions, these "call and reply" wall sets are a complete unit with bell, mike and receiver in neat wood case and only need a length of twin bell wire between them. Brand new, suitable for office or home, 25 per pair.

TERRY ANGLEPOISE LAMPS complete with flex and B.B.C. holder and shade. Will stay put, in any position, wall or machine fixing, 35/-, post 2/6.

VOLTMETERS. 0/300 v. A.C. 50 cy. 2½in. flush, moving coil. Rectifier type, 30/-, post 1/-; Also five 2 inch surface-type moving iron with open scale, only 60/-. Worth double.

R.F. UNITS TYPE 25. 50/65 Mc/s. Variable tuning, complete with valves. A fortunate purchase enables us to offer these units at the special low price of 35/-. Post 2/6.

RECEIVER R.1355. Specified for "Inexpensive Television." In original packing. With all valves, 38/6, carriage 7/6.

AMPLIFIERS. A high-fidelity unit with separate bass and treble controls, constant impedance attenuator for setting volume level. In metal case with handles, 15 watt output, for 200/250 v. A.C. mains operation. Intended for use with the Gaumont British Projector. Ideal for P.A. work, dances, etc. Less valves. £12/10/-. Or complete with all valves, £15/12/6. Carr. 10/-.

RECEIVER R1132A. 100/124 Mc/s. with 200/250 v. A.C. Power Pack and all valves, £6/15/-, carr. 10/-.

ROTARY CONVERTERS. Input 24 volts D.C., output 230 volts A.C. 50 cycles, 100 watt, 92/6 each. Also available with 12 volt input, 102/6, carr. 5/-.

MOVING COIL METER with 1 mA movement, 2½in. flush, rectifier type, scaled 0/100 volts A.C., Resistance 100 k. ohms. A very useful basic meter, 30/-.

WILCO ELECTRONICS DEPT. WW

204 LOWER ADDISCOMBE RD., CROYDON

★

'Radiospares' Quality Parts

The Service Engineer's First Choice

★

METERS

FOR WORKSHOP AND LABORATORY

Electrical test instruments repaired and calibrated, all types and makes, ammeters, voltmeters, ohmmeters, DC/AC multirange meters, etc., meters converted and rescaled to specification. Quick service for industry

THE ELECTRICAL INSTRUMENT REPAIR SERVICE

329 Kilburn Lane, London, W.9. Tel. LAD 4168

POTENTIOMETERS

Wire-wound and Composition types. Single, Ganged, Tandem Units. Characteristics: linear, log., semi-log., non-inductive, etc. Full details on request.

RELIANCE

RELIANCE MNFG. CO. (SOUTHWARK), LTD.
SUTHERLAND ROAD, HIGHAM HILL, WALTHAMSTOW, E.17.
Telephone Larkswood 3245

pitman
for technical books

Principles of Television Reception

By A. W. Keen, M.I.R.E., M.Brit.I.R.E., A.M.I.E.E. This book provides technicians and service engineers with a qualitative introduction to the theory underlying the design of television receivers and will be useful to students taking any examination of which the syllabus includes television principles. Illustrated. 30/- net.

Automatic Voltage Regulators and Stabilizers

By G. N. Patchett, Ph.D., B.Sc.(Hons. Lond.), A.M.I.E.E., M.I.R.E. This new book covers all types of voltage regulators from those of a few watts output to those controlling thousands of kilowatts. Profusely illustrated with photographic plates and clear diagrammatic drawings. 50/- net.

DETAILS OF OTHER BOOKS FROM:

Sir Isaac Pitman & Sons Ltd.
Parker St. · Kingsway · London, W.C.2

SITUATIONS VACANT

APPLICATIONS are invited for the following additional vacancies:—

1. A YOUNG Engineer to work in a team engaged in design and development of electro-mechanical and electronic equipment for aircraft. Qualifications required are: (a) sound technical background in light electrical or electronic engineering. (b) Imagination, initiative and energy. (c) Inter B.Sc. or H.N.C. B.Sc. would be an advantage. Ref. Y.E.

2. A MAN to act as Senior Laboratory Technician in a team engaged in the development of electro-mechanical devices for aircraft. Essential qualifications are: (a) sound practical experience in light electrical, electronic or allied engineering. (b) Ability to express a theoretical design in terms of a good practical layout. (c) Ability to control and supervise laboratory assistants and wiremen in the execution of the above designs. An ex-R.E.M.E. A.S.M. with some civilian experience or a senior radio service engineer with the ability to adapt himself to this more varied type of work would be acceptable. Ref. S.L.T.

3. LABORATORY Technicians with the following qualifications: (a) practical experience in light electrical, electronic or allied engineering; (b) ability to wire-up neatly equipment from a theoretical circuit and test same intelligently; radio service engineers with a desire to engage in more interesting and varied work would be acceptable. Ref. L.T.

PLEASE apply in writing, giving full particulars, to: Personnel Officer, Louis Newmark, Ltd., Prefect Works, Purley Way, Croydon, quoting the appropriate reference. [2827

THE ENGLISH ELECTRIC Co., Ltd., have vacancies at
LUTON and in Australia for
JUNIOR Engineers and
LABORATORY Assistants.
APPLICANTS should have a sound knowledge of electronic circuitry with preferably some radar experience.
THESE positions are permanent and progressive and attractive salaries are offered for able and experienced men.
ASSISTANCE with housing for some of the posts may be given, and a staff pension scheme is in operation.
APPLICATIONS to Dept. C.P.S., 336-7, Strand, W.C.2, quoting reference 456V. [2810

WIRELESS Station Superintendent required by the
NIGERIA Government Posts and Telegraphs Department for one tour of 18 to 24 months in the first instance. Option of appointment (a) on temporary terms with salary, etc., in scale £864* rising to £1,392 a year and gratuity of up to £150 a year, or (b) with prospect of pensionable employment with salary, etc., in scale £750 rising to £1,175 a year. Outfit allowance £60. Free passages for Officer and wife. Assistance towards cost of children's passages or grant of up to £150 annually for their maintenance in U.K. Liberal leave on full salary. Candidates must have had wide practical experience of modern radio techniques and equipment, in particular V.H.F. equipment, and preferably also V.H.F. multi-channel equipment.—Write to the Crown Agents, 4, Millbank, London, S.W.1, State age, name in block letters, full qualifications and experience and quote M2C/30086/WF. [2979

WIRELESS Operator Mechanics required for the
FALKLAND Islands Dependencies Survey for service in the Antarctic for tour of 18 or 30 months in the first instance. Salary in scale £330 rising to £420 a year plus free quarters, subsistence, clothing and liberal canteen stores while in Dependencies; it is possible to save almost all emoluments. Liberal leave on full salary. Candidates must be able to transmit and receive morse at 20 words a minute (plain language or code) and be capable of elementary maintenance of wireless transmitting and receiving equipment.—Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30572/WF. [2978

BUSH RADIO, Ltd., require for their development laboratories at Chiswick, W.4:
1. DEVELOPMENT engineers with at least 5 years' practical experience of domestic radio, television or communications circuit development; should be familiar with mechanical layout for production.
2. ASSISTANT development engineers with 2 years' practical experience of radio or television development and sound knowledge of measurement technique.
3. TECHNICAL assistants. Should have some practical experience and a real interest in radio and television. Preferably with technical knowledge to Inter. B.Sc. standard.
FOR Grades 1 and 2 it is desirable that applicants hold a degree or its equivalent qualification in engineering.
ALL the above positions are progressive and offer excellent prospects to men with ideas and the initiative to carry them out.
WRITE, giving full details of career to date and salary expected to: The Chief Engineer, Bush Radio, Ltd., Power Rd., Chiswick, W.4. [2806

SERVICE engineer, Glasgow, for amplifiers and recorders; mechanical dexterity advantageous; experience of TV neither necessary nor desirable.—Box 5625. [2964

ELECTRONIC engineer required immediately for development work on deaf aids.—Thomas Thirsk, 41, Lodge Rd., Croydon, Surrey. Thornton Heath 2165. [2824

MONEY BACK GUARANTEE **DUKE & CO**
621 ROMFORD ROAD, LONDON, E.12
C.W.O. or C.O.D. • TEL: GRA 6677

T.V. TUBES £5—12"

3 MONTHS' GUARANTEE. Still our best buy, as supplied to the trade for the past 3 years. Not Ex-W.D. Had some hours' use. Various types and makes. Picture shown to callers. Carriage and insurance 15/6 extra. Please quote make and type required, and set with model No. when ordering.

SPECIAL OFFER of tubes with burns for testing and spares at 30/- each, with cathode to heater short 50/- each plus carriage and insurance.

DUNLOPILLO EX-COACH SEATS. 34in. x 16in. x 4in. With back (19in.), 37/6. Ideal for cars, caravans and utilities. Carriage 4/6.

SPOTLIGHTS, 8/9. Butlers new but Ex-W.D. 7¼in. dia., 6½in. deep. These lights are similar to those sold for £3-£5, but finished black. This light is easily fitted to dumb irons of bumper. Bulbs now available 6 v. 36 watt and 12 v., 48 watt. 4/6 each.

SIDELIGHTS. 1/9. Infra-red glass. Easily changed for clear or red. Ideal tail lamps. As now law. Are over 2in. dia. New Ex-W.D. Post 9d.

AMPLIFIERS. Push-pull. 77/6, 7 watts output. A.C. or Universal. 4 valves and 1 rec. Ideal for Pick-up or Mike. Post 2/6.

AMPLIFIERS. 57/6. 4-watts output. 3 valves. A.C. or A.C./D.C. Ideal for Pick-up or Mike. Post 2/6.

RECTIFIERS. 8/9. T.V. type. Salvage, guaranteed, 250 volt at 200 mA. Also 180 volt at 40 mA, 3/9, and New, 350 volt at 200 mA, 12/9. Post 1/- each.

TELESCOPIC MASTS. Ex-W.D., but unused. Extend to 7ft. 6in. Base diameter ½in., tip ¼in. Closed length 15in. Ideal Aerial. **GIFT PRICE 5/9.** Post 1/3.

CRYSTALS. Germanium. Brand new, made by B.T.H. Give first-class results. **SPECIAL OFFER. 1/9.** Post 6d.

TRANSFORMERS. MICROPHONE TRANS. 2/9. E.M.I. type, fully shielded case. Post 1/-.

EXTENSION SPEAKER CABINETS. 9/9. Polished veneered. Ideal for 8in. speaker. Post 2/6.

EXTENSION SPEAKERS. Brand new 6½in. p.m. speaker (low impedance). Mounted on polished and veneered baffle stand, gold fret. 5ft. lead ready connected. **ONLY 19/9.** Post 1/9.

RADIOGRAM CHASSIS. End drive, **£6/17/6.** Salvage, reconditioned, 3-wave band, 5-valve superhet (latest midgets), ext. speaker and pick-up sockets. Post 3/6.

BEDSIDE T.R.F. RADIOS. 4 valve L. & M. wave bands. Walnut, plastic or white cabinets. Complete **£6/9/6**, plus 3/6 P. & P.

P.M. SPEAKERS. 12in. Truvox, 47/6. 10in., 25/9, 8in., 18/6, 6½in., 14/9, 5in., 13/9. All three ohms. Best makes, P. & P. 1/9.

MOTORS. 12-24 volts, with flexible shaft, 18 ct. gold brushes. 17/6. Post 2/6.

ACCUMULATORS. 7/9. New, 2 v. 45 amperes. Post & Pkg. 2/-.

BATTERIES. H.T. New 7/9, 90v. portable ex-W.D. 50v. 5/9. 90v. + 1½v., 8/9. 4½v. new 1/6, post 6d., post on H.T. batteries, 1/9.

700 MICRO AMP METER AND MOVEMENTS (Radiator) (Air), **12/9.**

SEND STAMP FOR 1954 CATALOGUE

HIGH-FIDELITY FREQUENCY MODULATION

REALISE THE FULL COMPASS OF YOUR EQUIPMENT.

OUR "WW" DESIGN FM AM VHF RECEIVER is available for EX-STOCK DELIVERY FIELD-PROVEN RELIABILITY AND SENSITIVITY.

Chassis with power supply.. £15.0.0
Less P/S £11.17.6
Complete kits £7.5.0

Leaflet 1/0.

Ring ARC 5078 for a demonstration.

Trade enquiries invited.

BEL SOUND PRODUCTS CO., Marlborough Yard, Archway, London, N.19.

LARGE SPEAKER CABINETS

15" Walnut Veneered Sandfilled Enclosure with top baffle £18.0.0. Walnut Veneered Corner Cabinet Goodmans Axiom 150 Mk. II with super-imposed grill on front £16.0.0.

ALAN CRANSTON, (*Cabinet Makers*), **20, Lorrimore Bldgs., Olney Road, Walworth, LONDON, S.E.17.**

PRE-SET CONTROL LOCK

Designed to lock the spindles of pre-set potentiometers or trimmers without rotational or lateral displacement of shaft.

Will accept wide range of panel thicknesses.

TYPE CH2 (right)
TYPE PK2 (left)
Very attractive appearance for panel mounting.

Send for leaflet 12

SUTTON COLDFIELD ELECTRICAL ENGINEERS

Clifton St., Sutton Coldfield, phone 5666

TELETRON SUPER INDUCTOR COILS

WITH MINIATURE DUST CORES

Type MAX. RF. Transformer, Triple wound for Xtal diodes. Extensively used as Radio "Head" for Recording and Quality amplifiers. 2/- each. Free from overlap.

DUAL WAVE TRF. COILS

Type TRF.A/HF. and TRF.A/D. Tuned anode with reaction. Aer.Pri. Windings with rising characteristic. Pre-aligned. 7/- pair.
S/Het. Range for S. M. and L.W. 6/- pair.
IFT's filters, etc. Stamp for data. TELETRON utilise all the features you expect from a good RF. Coil.

THE TELETRON CO., 266, Nightingale Road, London, N.9.

Trade enquiries to sole distributor. **SAM MOZER 59, Kendal Avenue, N.18.** Edm. 7707

SITUATIONS VACANT

THE English Electric Valve Co., Ltd., Chelmsford, requires the following technical staff for their camera tube division:—
(a) TEST ROOM SUPERVISOR.
(b) TEST CAMERA OPERATOR. Applicants should have H.N.C. in radio engineering or its equivalent, and some experience would be desirable.
(c) INSPECTOR. Experience of valve assembly and process detail is necessary and a science degree would be a considerable advantage.
(d) TECHNICAL ASSISTANT. H.N.C. is necessary for this vacancy, together with some knowledge of vacuum/chemical processing.
(e) CIRCUIT MAINTENANCE ENGINEER. Some experience in this field is highly desirable, together with suitable technical qualifications. IN certain cases housing assistance may be provided.
WRITE with full details of qualifications and experience and quoting relevant vacancy and Ref. SA32, to Dept. C.P.S., 536/7, Strand, W.C.2. [3009

THE McMurdo Instrument Co., Ltd., Ashtead, Surrey, have the following vacancies in their Development Group. Applicants must be of British birth.
(a) ELECTRONIC Development Engineers (2) for circuit and test gear development work. Applicants should have an engineering degree, H.N.C or A.M.I.E.E. and be capable of working on their own initiative under the general guidance of a section head.
(b) TECHNICAL Assistants (3) required for general development work on mechanical and electro-chemical development. Applicants should preferably have O.N.C. or equivalent in an engineering subject, and should be capable of making up development samples from rough sketches and sorting out experimental results, etc.
(c) LABORATORY Assistants to assist Development Engineers on electrical and mechanical work.
(d) A DETAIL draughtsman with experience in design of small electrical components, etc.
APPLY in writing to the Personnel Manager. [3010

ELECTRONIC Engineer required for development work on capacitance bridges and associated equipments, experience in this field essential, London area.—Write Box 5688. [2976

CHARGEHAND required for final test of radio and television; previous experience in a similar capacity essential.—Apply to Box 5495. [2034

ELECTRONIC engineers required by the General Electric Co., Ltd., Brown's Lane, Allesley, Coventry, in their development laboratories for work on the following items:—
(A) Application and circuit theory of transistors.
(B) Design of R.F. modulators.
(C) Investigation into valve parameters.
(D) Design of valve test apparatus associated with (C) above.
(E) Trials team in connection with guided weapons.
(F) Development of pulse circuitry techniques for guided weapons.
(G) Servo-Mechanisms.
(H) Microwave development.
(I) Test equipment.
(J) General Radar circuit development.
(K) Power units including electronic stabilizers and rectifier systems.
(L) Magnetic amplifiers.
APPLICANTS, preferably with a degree or an equivalent qualification, should have had at least two years' experience in the development and engineering of service equipment as well as experience in one of the above.—Reply stating age, qualifications and experience to the Personnel Manager, Ref. R.G [2990

ELECTRONIC engineer required by capacitor manufacturers (East London) for development work on test instruments and electrical research; opportunity for young engineer with some years' experience.—Write Box 5810. [3029

RADIO service mechanics required by Smiths (Radiomobile), Ltd., for many parts of the country.—Write details of experience and qualifications to Personnel Officer, Goodwood Works, North Circular Rd., London, N.W.2. [0342

DRAUGHTSMEN: vacancies for senior draughtsmen with experience of electronic and/or electro-mechanical engineering required preferably with experience of Ministry requirements.
EXCELLENT prospects with good commencing salaries; non-contributory pension scheme in operation; applications will be treated in strict confidence and should give full chronological details of qualifications, experience and age to JOHN A. SMITH, Ltd., 24, Lichfield St., Wolverhampton. [2958

EDITOR for technical publications dept. dealing with wide range of electronics and allied apparatus, exp. of handbook production essential.—N. London area; £750-£900 p.a.—Write, Box 5557. [2946

TELEVISION/Radio service engineer, fully experienced all makes; good references; able to drive, permanent position.—A. G. Allen & Co., Ltd., 3-4, Bridge Rd., Wembley Park. (Arnold 2261.) [2968

TECHNICAL Writer (Electronics) required. Applicants must have similar previous experience, including editing and layout, and have ability to write on electronic and radar equipment.
GOOD salary and conditions. Pension Scheme. APPLY, with full details, including salary, quoting No. 1485, to Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Rd., Brentford, Middx. [3026

ODDIE FASTENERS

Pat. 507249

THIS FASTENER WITH ENDLESS APPLICATIONS—SIMPLE—POSITIVE SELF-LOCKING. MADE IN A VARIETY OF TYPES AND SIZES.

SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS.

WIDELY USED IN THE RADIO INDUSTRY.

Illustrated brochures and other information will be gladly sent on request.

DEPT "W.W."

Oddie, Bradbury & Cull Ltd., Southampton

Tel.: 55833 Cables: Fasteners, Southampton

MORLEY TRANSFORMERS

QUALITY P.P O./P. TRANS. 20w., super Silcorlams Section low leakage windings, prim. ind. 75H. leakage ind. 075H. Sec. 3 and 15 ohms Prim. to indiv. requirements. Shrouded and term., wt. 5 lbs. **3 grs.** Ditto 15 w., **2½ grs. L.P. CHOKES,** 10H, 65 mA. **4/6** 15H. 100 mA., **10/6.** 20H. 150 mA., **12/6. CRT Hr.** Isolation Trans., 25% sec. boost volt, 2 v., **10/6**; 6.3 v., **10/6. MAINS TRANS.** 0-200/250 v. tapped prim. 250-0-250 v. 80 mA. 5 v. 2 a., 6.3 v. 4 a., etc., from **21/-**, 6.3 v. 1½ a. Hr. Trans., **7/6.** Quotations for specials and rewinds. Part P. & P. 1/-.

2, PAWSONS RD., W. CROYDON, THO 1605

YOUR METER DAMAGED?

Leading Electrical Instrument Repairers to the Industry

Contractors to The Ministry of Supply

Repairs by skilled craftsmen of all makes and types of Voltmeters, Ammeters, Microammeters, Multirange Test meters, Electrical Thermometers, Recording Instruments, etc. Quick deliveries—for speedy estimate send defective instruments by registered post to:—

L. GLASER & CO.

Electrical Instrument Repairers
96-100 ALDERSGATE STREET, E.C.1
(Tel : MONarch 6822)

ENGINEERS!

Whatever your age or experience, you must read "ENGINEERING OPPORTUNITIES." Full details of the easiest way to pass A.M.I.Mech.E., A.M.I.C.E., C. & G. (Electrical, etc.), General Cert., etc., on

144 PAGES "NO PASS—NO FEE" terms and details of Courses in all branches of Engineering—Mechanical, Electrical, Civil, Auto., Aero., Radio, etc., Building etc. If you're earning less than £15 a week, tell us what interests you and write for your copy of "ENGINEERING OPPORTUNITIES" today—FREE

Free!

B.I.E.T.

Dept. 257 College House, 29-31, Wright's Lane, London, W.8.

ANNOUNCEMENT!

DENCO (CLACTON) LIMITED

In order to avoid confusion between the well-known trademark "DELCO" and our own trademark "DENCO" and as "DELCO" was registered as a trademark before "DENCO", we have agreed to withdraw our "DENCO" trademarks from the Register and revert to our former trademark "MAXI Q". In future all of our products will be manufactured, advertised and sold under the registered trademark "MAXI Q".

DENCO (CLACTON) LIMITED

357/359 OLD RD., CLACTON-ON-SEA, ESSEX

DUODE N.E.W.S

ABERDEEN
TOKYO
VANCOUVER
CAPE TOWN
STOCKHOLM
HONG KONG
TORONTO
SINGAPORE

And also El Ballah, Guadalajara, Burnley, Ryukyu, Maracaibo, Hoddesdon, Ponoka, Port of Spain, Wellington, Soho, Colombo, Hoghton and all !

As you may have guessed by now these are all places to which Duodes have gone recently, bringing natural sound to people who want to hear recorded or broadcast music at its very best.

North, East, West, South, look them up and you will see how far and wide Duode quality spreads its influence amongst those who listen critically. If we could publish even a few of the letters which come to tell how much joy Duodes give to their owners you would be convinced.

As it is, we can only tell you, and again say that if you have a keen ear and can listen critically and objectively you must hear a Duode properly mounted and demonstrated.

Why not send us a line today, for the latest Duode details.

BARKER SOUND REPRODUCERS

3 NEWMAN YARD, LONDON, W.1

SITUATIONS VACANT

SENIOR Mechanical Designer/Draughtsman required to lead a newly formed section engaged on special machine and equipment development required for the manufacture of paper dielectric capacitors.
APPLICANTS should possess H.N.C., have served an engineering apprenticeship, or have sound workshop experience in light engineering, and have held a position of responsibility in a drawing office.
THE company is engaged on a major expansion programme in this field and the position will offer wide scope for an individual who has original thoughts and inventive talents for the creation of machines applicable to mass-production methods.
APPLY to Box 5771, quoting B.H.2. [3017

COMPETENT radio and television engineer required to take charge of a manufacturer's service department; ability to control staff and deal with telephone inquiries and correspondence, etc., essential.—Apply to Box 5496. [2935

AN outstanding opportunity is offered to an electronics liaison engineer in the new electronic equipment division of an old-established electrical company who are expanding to a South Coast area.
THE qualifications for this post are a sound technical background, considerable knowledge and experience of centimetric radar systems, pulse and microwave techniques; applicants should also be capable of co-ordinating the work of design and production authorities, and be able to accept the responsibility for assessing test equipment and specification requirements for radar production projects.
THE salary for this post will be commensurate with ability.—Interested applicants should write giving full details of the above experiences and age to Box 4830. [2817

ELECTRONIC Functional Test Dept. of The English Electric Co., Ltd., Luton, require additional staff with experience in radio and radar techniques and testing, or electronic sub-assemblies and systems.
HOUSING assistance available to successful applicants from the Greater London area. Write, stating age, qualifications, experience, present salary and Ref. S.A.58A, to the Personnel Manager, The English Electric Co., Ltd., The Airport, Luton, Beds.

BRITISH INTERNATIONAL AIRLINES, Ltd., Kuwait, invite application from single men holding a radio engineer's licence categories A and B or those prepared to accept separation from their families.
PREFERENCE will be given to applicants with Dakota aircraft radio installation experience.
EMOLUMENTS, free of local taxation, and conditions of service include:—
1. BASIC salary in the scale £715×£25 to £815.
2. OVERSEAS Allowance: Single men £200 p.a., married men £250 p.a.
3. COST of Living Allowance of Rupees 706 per month.
4. RECREATIONAL transport and fully furnished quarters at nominal charges.
5. FREE medical service, and home leave at the rate of eight weeks for each year's service in Kuwait.
6. THREE-YEAR contract, subject to normal termination clauses.
APPLICATIONS should be addressed to the Staff Manager, Subsidiaries, British Overseas Airways Corporation, Airways House, Great West Rd., Brentford, Middlesex. [2995

SENIOR and Junior Electronic Engineers required for audio and acoustic projects. Applicants should give full details of qualifications and experience by letter to—Personnel Manager, Pye, Ltd., St. Andrew's Rd., Cambridge. [2812

TECHNICAL writer (male or female) holding B.Sc. or similar degree, required to prepare instructional handbooks on complex electronic equipments.—Apply, stating qualifications, to Cinema-Television, Ltd., Worsley Bridge Rd., Lower Sydenham, S.E.26. [2987

TECHNICAL author for several interesting projects in North London area; exp. of electronics and communications desirable; perm. position for suitable applicant; salary scale £650-£800 p.a. depending on exp.—Write, Box 5558. [2947

TEST Room Supervisor required by electronic and radar firm of international repute for appointment which will provide an outstanding opportunity to the successful applicant in an entirely new production group located in the South Coast area.
ESSENTIAL qualifications are:—
(a) GOOD technical background.
(b) EXPERIENCE of the testing requirements associated with the production of microwave radar, servo and pulse equipment.
(c) ABILITY to organise and control staff.
SUPERANNUATION scheme exists and housing assistance may be given. Write fullest details of education, experience and age, to—Box 4907. [2852

EXPERIENCED radio testers and inspectors required for production of communication and radio apparatus, also instrument makers, wirers and assemblers, for factory test apparatus.—Apply Personnel Manager, E. K. Cole, Ltd., Ekco Works, Malmesbury, Wilts. [0238

CHARGEHAND radar mechanic required to supervise a small maintenance section responsible for servicing microwave test equipment, previous experience of microwave equipment essential; applicants should have C. & G. Telecoms. III or National Certificate in Electrical Engineering.—Apply in confidence to Personnel Supervisor, Ferranti, Ltd., King's Cross Rd., Dundee. [2961

GALPIN'S

ELECTRICAL STORES

408 HIGH STREET, LEWISHAM, S.E.13.

Tel.: Lee Green 0309. Nr. Lewisham Hospital.

TERMS: CASH WITH ORDER. NO C.O.D.

All goods sent on 7 days' approval against cash.

EARLY CLOSING DAY THURSDAY

HEAVY DUTY SPOT WELDER TRANSFORMERS, input 200/250 volts. OUTPUT a combination of 2, 4, 6, 8, 10, 12 volts at 120/150 Amps. New £6/15/- each, carriage 6/-.
LIGHT ARC WELDING TRANSFORMERS 200/250 volts Input. Output 40/60 volts, 30/40 Amps. £7/5/- each.
MEDIUM SPOT WELDING TRANSFORMERS, Input 200/250 volts. OUTPUT a combination of 2, 4, 6, 8, 10, 12 volts at 50/70 amps., new £5/2/6, C/paid.
HEAVY DUTY L.T. OUTPUT TRANSFORMERS 200/250 volts Input. Output a combination of 6, 12, 18 and 24 volts at 30 amps. £4/2/6 each. C/paid.
Another Input as above, Output 0, 6, 12, 18, 24 volts at 12 amps., 55/- each, post 2/-. Another Input as above, OUTPUT 0, 6, 12, 18, 24 volts 6/8 amps., 46/6 each.
HEAVY DUTY L.T. TRANSFORMERS, suitable for rectifiers, soil heating, etc. Input 200/250 volts, Output a combination of 6, 12, 18, 24, 30, 36 volts at 15 amps, 67/6 each, post 2/6. Another Input and Output as above but at 6 amps., 47/6, post 2/-. Another input and output as above but at 4 amps., 36/6 each.
CONVERTORS, 400 watts output, 24 volts D.C. input, 50 volts 50 cycles 1 phase output. Complete with step-up transformer from 50 volts to 230 volts at 400 watts. £12/10/- each C/F.
Ditto 200 watts. £9/10/- each C/F, fully guaranteed.
ROTARY CONVERTORS. 230 volts D.C. input, 230 volts A.C. output. 50 cycles 1 phase at 250 watts. £15 each C/F.
HEAVY DUTY CHARGERS. 200/250 volts A.C. Input 36 volts at 36 amps. Output D.C. £25, C/F.
LARGE STUD TYPE DIMMER RESISTANCES or 200/250 volts at 400 watts. 32/6 each.
EX-RADAR MAINS TRANSFORMERS. Input 230 volts. Output 4 or 5 Kilo-volts at 30 min., also 3 L.T. windings 4 v. 2 a., 6.3 v. 2 a., 2 v. 2 a., these transformers are capable of a larger output than stated and are immersed in oil. £3/15/- each, carriage 5/-.
DIMMER RESISTANCES. Large type 2,000 watts rating. 45/- each, carriage 5/-.
MAINS TRANSFORMERS (NEW), input 200/250 volts in steps of 10 volts, output 350/0/350 volts, 180 m/amps. 4 volts 4 amps., 5 volts 3 amps., 6.3 volts 4 amps., 45/- each, post 1/6; another 350/0/350 volts 180 m/amps., 6.3 volts 8 amps., 0/4/5/ volts 4 amps., 45/- each, post 1/6; another 500/0/500 volts 150 amps., 4 volts 4 amps. C.T., 6.3 volts 4 amps., C.T., 5 volts 3 amps., 47/6 each, post 1/6; another 425/0/425 volts 160 m/amps., 6.3 volts 4 amps. C.T., twice 5 volts 3 amps., 47/6 each, post 1/6.
MAINS TRANSFORMERS, 200-250 volts input, output 400/0/400 volts, 280 m/amps., 6.3 v. 8 a., 2 v. 3 a., 5 v. 3 a. 4 v. 2 a., 4 v. 2 a., the last two heaters insulated at 8,000 volts, 85/- each; another 200/230 volts input, output tapped 0, 9, 18 volts at 4 amps., 25/- each, post 1/-.
Ex-U.S.A. ROTARY CONVERTORS, 12 volts D.C. input, outputs 500 volts 50 mA., 275 v. 100 mA. Complete with smoothing, 22/6 each carriage 2/6. As new.
Ex-NAVAL ROTARY CONVERTORS, 110 v. D.C. input 230, volts A.C. 50 cy., 1 ph. 250 watts, output. Weight approx. 100 lbs. £12/10/-. c/forward.
Ex-W.D. U.S.A. HAND GENERATORS less winding handle, output 425 volts at 110 mA., at 6.3 v., 2½ amps., complete with smoothing. 30/- each, carriage 2/6.
ELECTRIC LIGHT CHECK METERS, useful for sub-letting, garages, etc., all for 200/250 volts A.C. mains, 5 amp. load, 19/- each; 10 amps., 22/6; 20 amps., 27/-; 25 amps., 32/6.
METERS. Moving coil, 0 to 14 amps. 18/6 each. Ditto, Moving Iron, suitable for A.C. 0 to 30 amps., 25/- each. Another moving coil, 100 to 250 amps., D.C. 35/- each, all 4in. scale.
1,000 WATT AUTO WOUND VOLTAGE CHANGER TRANSFORMER tapped 0/110/200/230/250 volts. £5/15/- each, carriage 4/6.
1,500 watt ditto, £7/15/-, carriage 7/6.
350 watt 55/-, 500 watt 75/-, 200 watt 45/-.

Clients in Eire, please allow at least double the carriage stated to allow for custom clearance charges.

QUARTZ CRYSTAL UNITS

QCC

Type B7

The type B7 unit is mounted in the standard B7G valve envelope and is hermetically sealed and fully evacuated.
Available for the frequency ranges from 100 kc/s. to 500 kc/s. and from 3 Mc/s. to 16 Mc/s. Gold electrodes applied by cathodic sputtering give permanence of calibration. Normal adjustment accuracy 0.01%. Max. adjustment accuracy 0.003%.

Early delivery can be given of most frequencies, and we will be pleased to quote for your specific requirements.

THE QUARTZ CRYSTAL Co. Ltd.
63-71 Kingston Road,
NEW MALDEN, SURREY
Telephone: MALden 0334 *Cables, etc.:* QUARTZCO NEWMALDEN

SHERWOOD - INSTRUMENTS LIMITED

Production Manufacturers of Capstan and Machined Components—Light Accurate Sheet Metal and Press Work. A.I.D. Approved.
Enquiries Invited. Telephone Hampstead 6655
5 ROSEMONT ROAD, LONDON, N.W.3

TELECRAFT

TV AERIALS
ARE CHEAPER AND BETTER
Send for Lists
TELECRAFT LTD.
THORNTON HEATH, SURREY.
THOrnton Heath 1191-2

ARKAY WORLD'S FINEST KITS

RADIOS PHONOGRAPHS TV
TEST EQUIPMENT HI-FI
Write for FREE Brochure
Radio Kits, Inc. • 120 CEDAR STREET
NEW YORK 6, NEW YORK • U.S.A.

Build a really Portable Tape Recorder with the new
"CHALLENGER"
Three speed high fidelity tape deck

A first-class precision-built deck.
Beautifully finished in Old Gold stove enamel
Size only 11" x 7½"—Weight 6 lb.
Price £10.10.0
Send stamp for details
E.W.A.
266 Warbreck Drive, Blackpool

SITUATIONS VACANT

CAPACITOR manufacturers in South London require an assistant production manager; applicants should have experience of various types of capacitors and be able to handle production schedules.—Reply, stating age, experience and salary required, to Box 5267. [2911

TELEVISION engineers required for demonstration installation unit (T.V. transmission equipment); must be willing to travel overseas.—Apply by letter in first instance to: Engineer-in-Charge, Demonstration and Installation Section, Pye, Ltd., Cambridge. [2761

ELECTRONIC technician required for testing special equipment; sound basic knowledge of electronic instrument, radio or television circuitry essential; excellent prospects for successful applicant.—Elcontrol, Ltd., Wilbury Way, Hitchin Herts. Tel. 1596. [2928

PARTRIDGE TRANSFORMERS, Ltd., require junior designs engineer; young man having slight experience of transformer designing preferred; very good salary; permanent position.—Apply in writing, Chief Engineer, Partridge Transformers, Ltd., Tolworth, Surrey. [3022

ELECTRONIC or electrical engineer required for senior post in development laboratory of capacitor manufacturer; excellent scope for man under 35 with experience in capacitor, insulation or cable industry; works East London.—Write in confidence Box 5271. [2907

PYE, Ltd. require experienced development engineers for radio receiver development in Cambridge; salaries in the range of £400 to £800 according to qualifications.—Apply Personnel Department, Pye, Ltd., St. Andrew's Rd., Cambridge. [2997

LEADING capacitor manufacturer requires technical sales assistants for: internal vacancies; salaried position pension scheme; electronic/electrical experience essential.—Write, setting out full details of age, experience and salary required, to Box 5266. [2910

FULLY experienced Radio/Television Engineer, able to drive, required by Relay Radio and Television Rental Company, who are extending and developing in the West Midlands, living accommodation available; commencing salary from £550; excellent prospects for progressive man.—Box 5689. [2977

ELECTRONIC Engineer (about 30 years) required by Scientific Instrument Makers for servicing photo-electric instruments. Good prospects for keen man. Camden Town district. Five-day week, superannuation, good welfare facilities.—Please apply, stating age, experience and salary required to Box 5084. [2876

ELECTRONIC development engineer required for firm in S.E. London: H.N.C. or equivalent standard with some electronic test laboratory practice, and a flair for design work; commencing salary in the neighbourhood of £600.—Write, giving full particulars, to Box 5769. [3015

DECCA RADAR, Ltd., require technical electronic inspectors for permanent and progressive staff posts; wide practical experience in a similar field is desirable, backed by a sound technical training.—Apply to the Personnel Officer, Decca Radar, Ltd., 2, Tolworth Rise, Tolworth, Surrey. [2963

SERVICE engineer required, good remuneration, illness and accident benefit, good prospects, furnished flat available if required; no T/V servicing after 6 p.m.; able to drive; only first-class men capable of working without supervision need apply.—N. E. Chapman, 48, New Rd., Peterborough. [2994

SENIOR Development Engineer required for work on impregnated and other dielectrics; the applicant should be a physicist, physical chemist or electrical engineer of Degree standard, and will be required to initiate and supervise the development through all its stages.
THE position offers exceptional scope to a man of better than average capabilities; well-equipped laboratory available, but successful applicant will be required to improve facilities as need arises.
APPLY to Box 5770, quoting B.H.1. [3016

TECHNICAL Transistor (British born) with fluent Dutch and/or German or French for international electrical concern in Holland; sound knowledge of electronics and television; preferably unmarried and willing to live abroad; salary according to qualifications.—Full details to Box 5778. [3025

TRANSFORMER Designer required for development projects involving audio-frequency power transformers, pulse transformers, oil-filled units, etc.—Apply stating age, qualifications and experience, to The Personnel Manager (Ref. R.G.), The General Electric Co., Ltd., Brown's Lane, Allesley, Coventry. [3260

RADIO and radar testers; first-class men required for work on V.H.F. communication gear and Government contracts for radio and radar equipment by Midland manufacturers.—Men with wide experience of fault finding in any of the fields mentioned should write, giving full details, to Box 4508. [2755

EXPERIENCED fault-finders wanted by Midland manufacturers of radio equipment; permanent posts located in the Midlands are offered to men with experience of radar, radio control, V.H.F. equipment.—Write, stating fully experience and salary required, to Personnel Manager, Box 4509. [2756

THE MAGNEGRAPH RECORDING CO. LTD.

1, Hanway Place, London, W.1.

SPECIALISTS ONLY IN MAGNETIC RECORDING EQUIPMENT.

Send stamped addressed envelope for details of :-

★ HIRES
★ SALES
★ REPAIRS
★ DEVELOPMENT
★ DESIGN
★ ACCESSORIES

Telephone: Langham 2156

BRASS, COPPER, DURAL, ALUMINIUM, BRONZE
ROD, BAR, SHEET, TUBE, STRIP, WIRE
3,000 STANDARD STOCK SIZES
No Quantity too Small · List on application
H. ROLLET & Co., Ltd.
6 Chesham Place, S.W.1. *SLOane* 3463
ALSO AT LIVERPOOL, BIRMINGHAM, MANCHESTER, LEEDS

THE
DESIGN and DEVELOPMENT
of specialised equipment for
Research and Industry.
DUN-SOBIESON ELECTRICAL CO.,
17 Victoria Gardens, London, W.11. *Park 6636*

"CALLBOY"

'InterTalk'
CARRIES YOUR VOICE
COMPLETE INTER-COM SYSTEM FOR OFFICE FACTORY, STORES, ETC.
EASCO ELECTRICAL LTD. Dept. W.W.
Brighton Terrace, S.W.9
Phone/Grams : BRIxton 4961-2-3.

1954-5
CATALOGUE
JUST RELEASED
★ 60 PAGES
★ 2000 COMPONENT TYPES
★ 500 ILLUSTRATIONS
PRICE 1/-
COVENTRY RADIO
189 DUNSTABLE RD., LUTON
Tel : LUTON 2677

SOUTHERN RADIO'S WIRELESS BARGAINS

TELESONIC 4-valve Battery Portable. Complete with Hivac Valves. In Metal Carrying Case. Simply converted to Personal Portable, £2 including Conversion Sheet.

TRANSMITTER-RECEIVERS. Type "18" Mark III. COMPRISING SUPER-HET RECEIVER and TRANSMITTER. TWO UNITS CONTAINED IN METAL CARRYING CASE. Complete. 8-valves. BARGAIN CLEARANCE OF REMAINING STOCK, £4/10/-.

RECEIVERS TYPE "109" 8-VALVES WITH VIBRATOR PACK FOR 6-volts. BUILT-IN SPEAKER. 1.8 to 8.5 Mcs. Contained in Metal Case. Perfect. 100 ONLY, £5. Bargain Clearance of Remaining Stock.

BOMBSIGHT COMPUTERS. Ex-R.A.F. New. Contains Gyro, Motors, Rev. Counters, Gear Wheels, etc., etc. Ideal for Model Makers, etc., £3/5/-, plus 10/- carriage.

CRYSTAL MONITORS. Type 2. New in Transit Case. Less Crystals. 8/- each.

LUFBRA HOLE CUTTERS. ADJUSTABLE ⅜ to 3½ins. For Metal, Wood, Plastic, etc., 6/6.

RESISTANCES. 100 Assorted. Useful Values. Wire end, 12/6 per 100.

CONDENSERS. 100 Assorted. Mica. Metal Tub, etc, 15/- per 100.

PLASTIC CASES. 14in. by 10½in. Transparent. Ideal for Maps, Photos, Display etc., 5/6.

STAR IDENTIFIERS. Type I A-N. Covers both Hemispheres. In Case, 5/6.

CONTACTOR TIME SWITCHES. Complete in Sound Proof Case. 2 Impulses per sec. Thermostatic Control, 11/6.

REMOTE CONTACTORS for use with above, 7/6.

MORSE TAPPERS. Standard Type ex-Govt., 3/6. Heavy Duty Type "D," 8/6. COMPLETE **MORSE PRACTICE SET** with **BUZZER, 6/9.**

DIMMER CONTROLS. Bakelite. Wire Wound. New, 1/3 each.

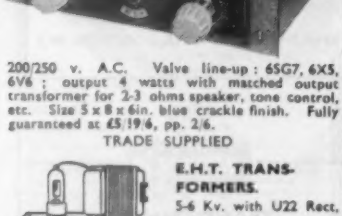
MAGNETIC RELAY SWITCH. Bakelite. 5c/723, 2/6 each.

METERS. 12 Instruments may need adjustment or cases broken, 38/- for 12.

Full List OF RADIO BOOKS 2½d.

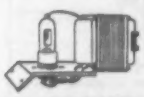
SOUTHERN RADIO SUPPLY LTD.
11 Little Newport Street, London, W.C.2.
Gerrard 6653.

3 Valve AMPLIFIER for Gram, Mike, Radio, etc.



200/250 v. A.C. Valve line-up: 6SG7, 6X5, 6V6; output 4 watts with matched output transformer for 2-3 ohms speaker, tone control, etc. Size 5 x 8 x 6in. blue crackle finish. Fully guaranteed at £5.19/6, pp. 2/6.

TRADE SUPPLIED



E.H.T. TRANSFORMERS. 5-6 Kv. with U22 Rect. 37/6, pp. 2/6.

TRANSFORMERS Prim. 200-240 tapped. Sec. 300-0-300 80 MA., 6.3 v. 3 amp. 4 v. 2 amp. Tropicalised drop-through type 11/6, pp. 1/6.

BARGAIN OFFER—New shop-soiled Portable Tape Recorder by well known maker. 200/250 A.C. 2-speed (7½ and 12½). Good reproduction on speech and music, records from radio or pick-up. List price £69. **Our price £37/10/-,** incl. hand mike.

Jackson's Radio Supplies
163, Edgware Road, London, W.2

SITUATIONS VACANT

A VACANCY occurs with a leading manufacturer for a man experienced in waveguide measurement; an ex-Serviceman with the necessary experience of testing and fault finding on radar gear would be considered.—Write stating age, experience and salary required to Box 5564. [2955

SENIOR draughtsmen (electrical) required by aircraft company; applicants should have considerable experience in latest types of aircraft electrical installations; progressive and pensionable position; write with full personal particulars to—Box No. 5497, and quote reference H.231. [2956

MALE Trainee, aged 25-35 required with sound basic knowledge of electricity for work in connection with specialised electrical equipment and installations in operating theatres. Salary according to age and experience. Apply in writing to Secretary, The London Hospital, Whitechapel, E.1. [3011

SENIOR Mechanical Designers and Draughtsmen required for Radio and Television Design Department. Apply in writing, giving full details of age, experience and qualifications, to Personnel Department, Murphy Radio Ltd., Welwyn Garden City, quoting "Design Department." [2852

ENGINEER, experience of mechanical design of subminiature electronic equipment. Applicants should be familiar with layout and wiring to interservice standards, design and manufacture of mechanical parts and preparation of working drawings. Degree not essential, preference given to persons with good practical experience. (Ref. 86.)

EXPERIENCED Wiremen for work on experimental subminiature electronic equipment. Applicants should be used to working direct from circuit diagrams and be familiar with workshop practice. Ability to prepare drawings an advantage. (Ref. 87.)
PLEASE write in detail, quoting reference number of position sought, to: The Personnel Manager (Technical Employment), De Havilland Propellers, Ltd., Manor Rd., Hatfield, Herts. [2892

SCIENTIFIC Instrument Makers in North London have a few vacancies for skilled laboratory assistants and wiremen for the development and production of high quality electrical and electronic apparatus. Five-day week, canteen, good welfare facilities.—Please apply, stating age, experience and salary required, to Box 5083. [2875

ELECTRONIC draughtsmen with good experience in layout work are required by the Nelson Research Laboratories, Stafford, for work on prototype equipment; this post offers scope for advancement to men of initiative; only men with experience will be considered. —Reply quoting Ref. 1243A, to Dept. C.P.S., 336-7, Strand, W.C.2. [2957

WANTED, top grade television service engineers with first-rate practical experience over a wide range of makes. Able to drive and must have real ability to diagnose faults and effect repairs quickly. Greater London area. Commencing salary £700-£800 per annum. Pension scheme. Only really first-grade men should apply.—Please telephone Museum 6986, Ext. 201. [3033

AN opportunity for young, versatile and ingenious electronic engineers to gain experience in the application of transistors to a wide variety of circuits is offered by the English Electric Company, Ltd., Luton. Interviews may be arranged locally to suit applicant's own convenience.—Write with full details to Dept. C.P.S., 336/7, Strand, W.C.2, quoting Ref. 1325. [3006

PHILIPS BALHAM WORKS, Ltd., 45, Nightingale Lane, Balham, S.W.12, require graduate in electrical engineering or physics, preferably with experience in electronics, for development of nucleonic and radiation instruments; permanent appointment with excellent prospects.—Write, giving full details of age, experience, etc.. [2914

ASSISTANT required to electronic engineer for servicing of low frequency equipment used for the measurement of stress and vibration and to assist in its development; progressive staff appointment with pension scheme.—Apply in writing to the Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middlesex, quoting reference SO/T. [3066

RADIO testers required, some V.H.F. experience desirable together with some servicing knowledge on domestic or service equipment. —Applications, giving full details of previous experience and qualifications, should be submitted in writing to the Personnel Manager, Pye Telecommunications, Ltd., Newmarket Rd., Cambridge [2965

MITCHAM WORKS, Ltd., have vacancies for technical assistants, able to carry out without close supervision, measurements on radio and/or television receivers and associated components. These posts offer excellent opportunities for young men to enter the factory laboratory of a leading receiver manufacturer.
COMMENCING salaries in accordance with age, experience and qualifications.—Candidates, who should have academic qualifications in radio to the standard of H.N.C., should apply in writing to the Personnel Officer, Mitcham Works, Ltd., New Rd., Mitcham Junction, Surrey, quoting reference G.1. [2989

SSC Bargains from SHERMAN'S

All Car. Paid and Money-Back Guarantee!

HIGH PRESSURE REDUCING VALVE
Complete with 0-3,000lb. per sq. in. pressure gauge. Suitable for Compressors, Cylinders of Gas, etc.
Slightly used. **8/6**
Brand new and boxed. **12/6**

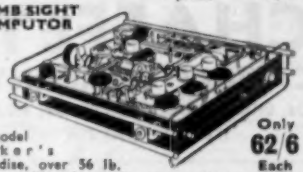
AIR BOTTLE
23in. x 5in. diam. Tested to 300lb. per sq. in. Suitable for above valve or compressor **25/-**

Set of TWIST DRILLS
9 drills, 1/16—¼in., complete with plastic case and stand. Brand new **4/6**

APOLLO SPRAY GUN
Ideal for model maker and handyman. Will spray paints, insecticides, etc. Will work from foot pump, spare car tyre, compressor, etc. New and boxed **15/-**

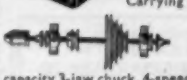
ALL-STEEL TOOL BOX
Complete with removable inner tray. Fitted with strong hasp, staple and carrying handles. O.A. size 24in. x 8in. x 8in. Made to sell far in excess of our price. **36/6**

BOMB SIGHT COMPUTOR



A model maker's paradise, over 56 lb. of magnificently made gears, driving shafts, bearings, miniature motor, repeater motor, gyroscopes, etc. All supplied in a strong, wooden transit case 24in. x 22in. x 11in. high which itself is ideal as a tool box. **Only 62/6 Each**

OHMMETER. 4 scales, 2½in. diameter, reading 0-5,000 ohms, 0-60 mA., 0-1.5 v., 0-3 v., suitable for continuity testing. Will operate from 1.5 v. battery, strong case, with full instructions engraved on back. Brand new. Carrying sling, 1/- ea. **19/6**



ALL-PURPOSE STEEL SPINDLE
15in. long. Complete with ¼in. capacity 3-jaw chuck, 4-speed pulley. Ideal for circular saw grinder, polisher, drill, etc. **37/6**

1/6th h.p. **MAINS MOTOR,** 230/250 v. single phase, induction type motor suitable for above **75/-**

TERMS—CASH WITH ORDER. C.O.D. 1/- EXTRA
Phone Orders Accepted. **(Dept. W4)**
Showrooms:
479 HARROW ROAD, LONDON, W.10.
LADbroke 1718.
HIGH STREET, HARLESDEN, N.W.10.

SHERMAN'S SSC SUPPLY COMPANY

LONDON CENTRAL RADIO STORES

FRACTIONAL H.P. MOTORS. AC/DC 100-250 v. With voltage control resistor. Size approx. 4½ × 4in. Weight 6 lb., 57/6, carr. paid.

4-VALVE (Used) SUPERHET UTILITY RECEIVERS.—Medium wave band only. Four valves, P.M. Speaker complete in pine wood cabinet size 15½ × 13 × 8½in. In good condition. A.C. mains 200/250 volts. Price £4/10/-, Carr. etc. 7/6.

UNISELECTOR SWITCHES. Have many applications including automatic tuning circuit selection, etc. Operates on 250-50 v. Full Wipers, 3-bank, 12/6. Half Wipers, 6-bank, 22/6. Plus 1/6 P. & P.

GROOVE LOCATING UNITS enabling operator to preselect any point on 10, 12 or 16in. discs for playback purposes.
Consists of substantial machined casting with adjustable counterpoise pick-up arm fitted with high-fidelity pick-up and instantaneous calibrated groove selector with micrometer adjustment and "velvet touch" lever for dropping pick-up. £2/10/-, carr. paid.

ELECTRO MAGNETIC COUNTERS. Ex-G.P.O. every one perfect, electro-magnetic, 500 ohm coil, counting to 9,999, operated from 25-v.-50-v. D.C., 4¼in. long × 1½ × 1in., many industrial and domestic uses, 15/-. P. & P. 9d.

See previous issues for other bargains.

N.B.—Carriage charges relate to British Isles only.

23 LISLE ST. (GER. 2969) LONDON, W.C.2
Closed Thursday 1 p.m. Open all day Saturday

MAGNETIC SOUND HEADS
for Tape Recording Machines.
Also Miniature Types suitable for Cine Projectors.
Manufacturers' Contracts Undertaken
ALTAFLEX LTD.,
56 GT. HAMPTON STREET, BIRMINGHAM, 18

THE
CHAFFEY
CABINET COMPANY
63a, CHELTENHAM RD., LONDON, S.E.15
TEL: NEW CROSS 4766

NORWOOD TECHNICAL COLLEGE
Training in Radio, Radar, Television and Electronics.

Day and Evening Classes in preparation for Grad.Brit. I.R.E. City and Guilds Examinations, P.M.G. Certificates, R.T.E.B. Radio and Television Servicing Certificates.
Also special courses in Radar, Television, Electronics (Instrumentation).

London Fees for Full-time day Classes: FREE if under 18 years, £23 per year if 18 years or over.

Further particulars from Secretary, Norwood Technical College, West Norwood, London, S.E.27. (4338).

COUNTY BOROUGH OF BOLTON—EDUCATION COMMITTEE
BOLTON TECHNICAL COLLEGE
Full-time Course in Electronic Engineering

A three-year full-time course in Electronic Engineering is now available. Applicants should be between 16 and 18, and have taken, or be taking, General Certificate at the Ordinary Level in Mathematics or Physics, or equivalent courses in technical institutions.

This rapidly developing industry offers new and attractive openings to qualified men.

Application forms and particulars may be obtained from the Principal, Technical College, Bolton, Lancashire.

Education Offices, Nelson Square, Bolton.
W. T. SELLEY, *Chief Education Officer.*

SITUATIONS VACANT

FERRANTI, Ltd., Dundee, have a staff vacancy for an assistant test supervisor to control a department engaged in testing microwave devices; qualifications for this vacancy include a degree in electrical engineering or equivalent; previous experience in this type of work is an advantage but is not essential.—Apply in confidence to Personnel Supervisor, Ferranti, Ltd., King's Cross Rd., Dundee. [2960

SENIOR laboratory engineer required for work on television and sound wire broadcasting systems, duties include supervision of experiments and co-ordination of laboratory work with production of prototypes, good opportunities for advancement in expanding organisation; applicants should state age, qualifications, experience and present salary.—Box No. (London) 5577. [2958

ASSISTANT Engineers required in an electrical laboratory in West Surrey; preference will be given to those holding a degree or H.N.C., with experience in design and development of electrical relays for aircraft and other uses.—Apply in writing to the Chief Development Engineer, Waymouth Gauges and Instruments, Ltd., Station Rd., Godalming, Surrey. [2949

AN electronic engineer, possessing an academic or industrial degree and having at least 5 years' practical experience, is required for development work on a wide range of electronic instrumentation; the position offers ample scope for advancement in a rapidly expanding department.—Applicants should be 25 to 35 years of age, and should write giving full details, to Box 5487 [2915

EX-SERVICE radio-radar mechanics. A leading company in the electronic field has vacancies for men interested in manufacture and maintenance of radar equipment; opportunities occur in the factory and in the outside maintenance field for men who have had service training and some theoretical knowledge. Applicants should write giving full details of their experience, etc., to Box 5563. [2952

E.M.I. RESEARCH LABORATORIES, Ltd. invite applications from engineers with audio design experience, for posts involving interesting and varied work in the audio/video field. Applicants should have a University Degree in engineering or physics or equivalent professional qualifications.—Please write full details to the Personnel Dept. (RL/7), E.M.I., Ltd., Hayes, Middx. [2999

APPLICATIONS are invited from suitably qualified engineers for senior positions in the television and domestic broadcast receiver development laboratories; the vacancies offer considerable scope in the application of transistor and printed circuitry to this field. —Applications, stating fully age and experience and salary required, should be sent to The Personnel Manager, Box 5562. [3051

RADIO and television service engineer required by old-established dealer handling all first-class makes; permanent and excellent conditions with good pay and suitable accommodation available; only applications from fully experienced engineers will be considered.—Apply, stating age, experience and salary required; if required for interview expenses will be paid.—A. E. Hughes & Sons, 28, Clarence Place, Newport, Mon. [3015

McMICHAEL RADIO, Ltd., require senior and junior engineers in their equipment division laboratory at Slough; training and experience in the field of applied electronics (including communications) and experience of working with Government Departments are the chief qualifications required.—Write, stating age and full details of training, qualifications and experience, to the Chief Engineer, Equipment Division, McMichael Radio, Ltd., Slough, Bucks. [0196

PHYSICIST or electrical engineer for development work on transmission devices, miniature motors, and instrument servomechanisms; candidates aged 22/35 should have either (a) University degree in Physics or Electrical Engineering, (b) qualifications exempting from Grad. I.R.E. exam.; laboratory experience in light electrical engineering desirable.—Written applications, with full particulars, to Personnel Manager, Muirhead & Co., Ltd., Beckenham, Kent. [2929

ELECTRONIC engineer to work within our trials division at Edinburgh; the nature of the work involves conducting trials and evaluating the performance of fire control; navigational and landing systems under development; applicants should possess a physics degree or considerable recent practical experience in this field; good opportunity in expanding department; staff pension scheme.—Apply, quoting Ref. EE/TID and giving full details of qualifications and experience, to the Personnel Officer, Ferranti, Ltd., Ferry Rd., Edinburgh, 5. [2799

JOSEPH LUCAS (GAS TURBINE EQUIPMENT), Ltd., invites applications for electronic engineers. Some knowledge of servo mechanisms would be an advantage. Should have university degree. These appointments are pensionable and offer good prospects to individuals with initiative and technical ability. Salary will be in accordance with experience and qualifications.—Details of experience and qualifications should be sent to Personnel Manager, Joseph Lucas (Gas Turbine Equipment), Ltd., Shaftmoor Lane, Hall Green, Birmingham, 28. [3031

Smith's of EDGWARE ROAD

Send for Price List of parts for the

MIDGET SENSITIVE T.R.F. RECEIVER

as described in the April, 1954 issue

H. L. SMITH & CO. LTD.
287/289 EDGWARE ROAD, LONDON, W.2
Telephone : Paddington 5891
Hours 9 till 6 (Thursday, 1 o'clock)
Near Edgware Road Stations, Metropolitan & Bakerloo

PRECISION METALWORK
We specialise in manufacturing of Chassis in all metals, large or small quantities to your own specifications.
V. W. BEAMISH
Shardeloes Garage, Shardeloes Rd., New Cross, London, S.E.14.
Telephone : TIDeway 4795

WATERLOO RADIO
AUTO-CHANGERS, by a famous maker. 3-speed. New, boxed, in unopened cartons, £9/15/-.
METAL RECTIFIERS. Bridge, 2 Amp. 11/3. 3 Amp. 12/6. 4 Amp. 15/-, 6 Amp. 23/6, post 1/4.
TRANSFORMERS for use with above rects. Input 200-250V 50~A.C. to charge 6 or 12 Volts at:—1.5 Amps. 13/9, 3 Amps. 22/9, 6 Amps. 33/6, post 2/-.
Overseas enquiries invited.
35 TENISON WAY, LONDON, S.E.1.

ARIEL SOUND
Professional Recording Engineers
Public Address Equipment.
Electronic Design, Manufacture and Repair
(Please refer to Repairs and Services Section for details of some of our services.)
57 LANCASTER MEWS, LONDON, W.2
Telephone: Paddington 5092

A.T.D. INDUCTA Approved
TRANSFORMERS
of all types up to 25 KVA for Single or Three Phase operation, Phase Conversion, etc.
MAINS
Output, and Special Purpose Transformers for Radio Equipment; Chokes, etc.
COILS
for Contactors, E.M. Brakes, Air Valves, etc., and Coil WINDINGS for all purposes
SOLENOIDS
for A.C. and D.C. Operation.
W. F. PARSONAGE & Co., Ltd.
INDUCTA WORKS · Park Rd · Bloxwich · Walsall
Telephone : BLOX 66464

THE "FLUXITE QUINS" AT WORK

Just look at that silly young goose
I've told him before ! What's the use ?
In one way he's bright,
Always uses FLUXITE
But forgets you must switch off the juice !

Make a quick success of that soldering job—use Fluxite Paste. Suitable for all metals, except aluminium. Even solders and "tins" **dirty** metals !

And, remember, Fluxite "wipes" joints that other methods won't touch.

Used for generations in Government Works and by leading Engineers and Manufacturers. Of all Ironmongers in tins from 1/- upwards.

FLUXITE

SOLDERING PASTE

A STAUNCH COMPANION TO FLUXITE SOLDERING FLUID

Simplifies **ALL** *Soldering*

FLUXITE LTD BERMONDSEY ST · LONDON S.E.1

Fidelia

HAND BUILT QUALITY UNITS

MAJOR
10 VALVE
RADIOGRAM
CHASSIS £32/5/4

Appointments to hear our equipment can be arranged for almost any time convenient to you. If you are visiting the sea one weekend, why not arrange to call and see us, you may well hear something well worth the trip and to your financial advantage. Details of our hand built high quality equipment willingly sent on request.

Fidelia Standard 7 valve model....	£21 12 0
Fidelia Plus 8 valve model.....	£23 18 4
Fidelia 10 watt amplifier.....	£27 10 0
Fidelia De Luxe 9 valve model with 7 watt push-pull output stage....	£24 6 6

ALL MODELS have triode output stages. Variable Selectivity, Separate Bass and Treble Controls. Cathode follower detector, 20-20,000 cycle audio response.

ELECTRO *Acoustic* DEVELOPMENTS

2 ARMHURST ROAD, TELSCOMBE CLIFFS, Nr. Brighton, SUSSEX
Tel: Peacehaven 3186

SITUATIONS VACANT

DEVELOPMENT engineers, senior and junior, required for interesting work on new radio and television projects by leading manufacturers in W. London; applicants should have suitable academic qualifications and, for the senior posts, some previous experience; please write, in confidence, stating age, experience, qualifications and salary desired to—Box 5494. [2933

WIREMAN for modern research laboratory, capable of working to verbal instruction and able to do original layouts; City and Guilds or National Certificate an advantage, at least 3 years' experience imperative.—(Ref. 71) Write in detail, quoting reference No. of position sought to: The Personnel Dept. (Technical Employment), De Havilland Propellers, Ltd., Hatfield, Herts. [2818

TELEVISION and radio service department manager required in Liverpool district; staff appointment, pension scheme; applicants must have first-class qualifications technically and considerable administrative ability; salary £700 to £850; applications should give full particulars of age, training, technical qualifications and experience; letters should be clearly marked "Service Manager"; expenses in connection with interviews will be paid.—Box 4742. [2815

SENIOR coilwinding planning engineer required, experienced in the planning of radio and television coils; the selected candidate will have the drive and initiative necessary to deal rapidly with the day-to-day electrical and mechanical problems on the shop floor; East London area; this vacancy, for which a good salary will be paid, presents ample scope and opportunity to a man of first-class ability.—Please reply, giving full details of experience, to Box 5631. [2969

SENIOR design draughtsmen required by a large engineering company due to expansion of company's services and commercial business; applicants should have a comprehensive knowledge of mass production of radio, television and electronic equipment; salary up to £700 per annum, monthly status; the vacancies are of a permanent and progressive nature; company superannuation and life assurance schemes in operation.—Please reply, giving details of experience, to Box 5632. [2970

GROUND radio operators required for overseas service with International Aeradio, Limited; single men preferred; station allowance according to location; minimum total emoluments present posts, single staff £716 p.a., tax free; furnished quarters provided; generous U.K. leave; free air passages; kit allowance; possibilities of promotion.—Qualified candidates to whom replies only will be sent please write full particulars quoting GRO to Personnel Officer, 40, Park St., W.1. [2992

THE TELEGRAPH CONSTRUCTION & MAINTENANCE Co., Ltd., cable manufacturers, require a qualified electrical engineer to work on the design of cable fittings; the work involves the development of fittings for polythene insulated high voltage cables; practical experience of cable accessories desirable; this post is pensionable and carries a salary of £550-£600 upwards according to qualifications and experience.—Write, quoting reference RG/2 to Staff Officer, Telcon Works, Greenwich, S.E.10. [3000

THE GENERAL ELECTRIC Co., Ltd., Brown's Lane, Coventry, requires senior and junior electronic development engineers for work on guided weapons and like projects, particularly in the field of microwave and pulse applications; mechanical development engineers, designer draughtsmen and draughtsmen, preferably with experience of radar-type equipments, also required for the above projects; salary according to age, qualifications and experience. —Apply by letter, stating age and experience, to the Personnel Manager (ref. R.G.). [0259

ELECTRONIC engineers to work within our trials division at Edinburgh; the nature of the work involves conducting trials and evaluating the performance of fire control; navigational and landing systems under development; applicants should possess a physics degree or considerable recent practical experience in this field; good opportunity in expanding department, staff pension scheme.—Apply, quoting Ref. EE/TID and giving full details of qualifications and experience, to the Personnel Officer, Ferranti, Ltd., Ferry Rd., Edinburgh, 5. [2857

WAR OFFICE require assistant mechanical engineering officer (Recruitment Grade Professional) at Donnington Sub-Depot, to organize, control and supervise a workshop sector employing 30 to 40 civilians engaged on repair and calibration of electrical and electronic test equipment. Inclusive salary range £645 to £960 (provincial). Applicants must be British, of British parentage, and be Corporate Members of the Institution of Electrical Engineers, or have passed or be exempt from Sections A and B of their membership examination, or possess a University Engineering degree. Starting salary fixed according to age, qualifications and experience. Annual increments subject to satisfactory service. Posts temporary but long-term possibilities. Application forms, quoting reference D425/53A from M.L.N.S. Technical and Scientific Register (K), Aimeck House, 26, King Street, London, S.W.1. [2925

WIRE

on 1/4, 1/2 & 1 lb. reels

In stock for IMMEDIATE DELIVERY

per 1/4 lb. reel

ENAMELLED COPPER WIRE

swg.	price	swg.	price	swg.	price
16-18	1/6	28	2/4	38	3/3
20	1/8	30	2/6	40	3/6
22	1/10	32	2/8	42	4/3
24	2/-	34	2/10	44	5/6
26	2/2	36	3/-	46	8/9

DOUBLE COTTON COPPER WIRE

16	1/9	24	2/8	32	3/8
18	2/2	26	2/11	34	4/2
20	2/4	28	3/2	36	4/8
22	2/6	30	3/6	38	6/2

DOUBLE SILK COPPER WIRE

16	1/9	26	3/6	36	6/-
18	2/2	28	3/10	38	6/8
20	2/6	30	4/2	40	7/6
22	3/-	32	4/8	42	10/6
24	3/2	34	5/6	44	15/6

TINNED COPPER WIRE

16	1/6	20	1/10	24	2/2
18	1/8	22	2/-	26	2/4

ENAMELLED SINGLE SILK

20-22	2/6	32-34	3/9	40	7/6
24-26	2/9	36	5/-	42	11/0
28-30	3/3	38	6/-	44	17/0

INTERMEDIATE GAUGES AVAILABLE
Nickel chrome and resistance wires available.

Orders up to £1 — Postage 1/3
Orders £1 up — Post Free

HYGRADE

WIRE CO

Telephone: GERrard 0293

16 Gerrard Street, London W.1

WEBB'S RADIO

We are RE-BUILDING, ENLARGING and MODERNISING OUR PREMISES

and need

SENIOR SALES STAFF

for our new Shop and Demonstration Rooms

Good salary and prospects for the right men, who must have reasonable technical knowledge, combined with good address, to deal with interesting people and varied electronic apparatus (*High-pressure salesmen not to apply please.*)

Write to **WEBB'S RADIO**
14 Soho St., Oxford St., W.1

SITUATIONS VACANT

THE TELEGRAPH CONSTRUCTION & MAINTENANCE Co., Ltd., cable manufacturers, require an estimator; experience of cable estimating preferred, but applicants with sound knowledge of cable manufacturing methods would be carefully considered; must have completed National Service. Educational standard: G.C.E. (ordinary level) would be an advantage). Pension scheme, five-day week and all welfare facilities; salary in accordance with qualifications and experience.—Write details quoting reference CD/3 to Staff Officer, Telcon Works, Greenwich, S.E.10. [3002

B.B.C. requires engineer with university degree in electrical engineering or physics or equivalent, for field strength section of research department at Kingswood, Surrey, but involving frequent and long absence for radio frequency measurement throughout British Isles; experience of transmitters, aerials, measurement and use of receiving equipment desirable, knowledge of V.H.F./U.H.F. techniques an advantage; salary £645 rising to £860 p.a. in 5 years.—Applications stating age, education, qualifications and full details of experience, to E.E.O., B.B.C., London, W.1, quoting E.925, within 7 days. [3027

THE TELEGRAPH CONSTRUCTION & MAINTENANCE Co., Ltd., cable manufacturers, wish to appoint a technical assistant to be concerned primarily with the design of all types of cable; candidates must have previous experience of manufacture of cables, and some experience of cable estimating would be a distinct advantage; Inter-B.Sc. or a good National Certificate in Electrical Engineering; commencing salary £550 upwards according to qualifications and experience; pension scheme, five-day week and all welfare facilities.—Write details quoting reference CD/5 to Staff Officer, Telcon Works, Greenwich, S.E.10. [3001

BRITISH EUROPEAN AIRWAYS require engineers for the maintenance, overhaul and development of electronic flight simulators; applicants must have a fundamental knowledge of electronics, experience in the field of servo mechanisms, repeaters and in dealing with large-scale equipments is desirable; salary during a familiarisation period of six months will be £569 per annum, rising to range £608-£725 p.a.; additional payments made for any required shift working.—Written applications to Personnel Officer, Flight Operational Department, B.E.A., Keyline House, Ruislip, Middlesex. [3032

DRAUGHTSMEN are required for permanent posts in the field of Radar Engineering. Excellent opportunities for advancement. Salaries beyond A.E.S.D. rates to suitable applicants. Staff pension scheme and canteen facilities. 5-day week. British Nationality essential. Posts to be filled in the following grades; Senior Section Leader, Checker Draughtsman and Senior Design Draughtsman, Intermediate Draughtsman; Circuit Draughtsman, Installation Draughtsman.—Apply, quoting Ref. RLA/21, Chief Draughtsman, Decca Radar, Ltd., Research Laboratory, 2, Tolworth Rise, Surbiton, Surrey. [2856

RADIO (Meteorological) Mechanics required by Meteorological Office. Qualifications:—Basic knowledge of radio and radar and experience in maintenance/operation of radar equipment including oscilloscope. Successful applicants serve in United Kingdom and overseas. Commencing London salary £445 (age 25 or over rising annually to £540 subject to deductions for each year below age 25. Provincial salary £20 to £30 lower. Overtime, night duty allowance, etc. Promotion prospects. —Apply to Borough Employment Exchange (Dept. W.W.4). 256, Walworth Rd., London, S.E.17. [2872

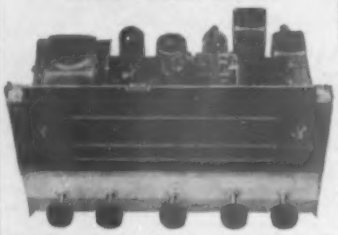
MARINE radar and radio service engineer. Applications from candidates with several years' experience in the maintenance of marine radar, radio and echo sounder equipment will be considered for the post of resident engineer in Port Said. The post, which is for a minimum tour of two years, will become vacant mid-summer and the suitable applicant will be required to commence training in England as soon as possible. The post provides free accommodation, all household expenses, houseboy, medical charges and passage for engineer and family.—W. H. Smith & Co., Electrical Engineers, Ltd., 66, Grosvenor St., Manchester, 1. [2941

MINISTRY OF TRANSPORT AND CIVIL AVIATION. Radio technicians (men only) required at aerodromes and radio stations in U.K. Special training courses for keen technicians with basic quals. Interesting work in progress providing electronic aids to navigation. Prospect of permanent pensionable posts. Rates of pay (London) from £330 p.a. age 19 to £445 at 25, rising, subject to qualifying test to £540. Rates slightly lower for provinces. Candidates aged 19 or over with practical experience in maintenance of radio or radar equipment should apply to Ministry of Labour and National Service, Chadwick St., London, S.W.1, quoting Order No. 6627. [2943

A SENIOR appointment will shortly be filled in the London laboratory of a firm holding contracts in guided weapon and kindred fields; engineers who wish to be considered for this vacancy should be graduates and should have had some experience in industrial engineering laboratories; some production engineering experience in addition to microwave electronic and/or servo experience would be an advantage; starting salary will range according to age and experience and will be on a generous scale and will be subject to good increases, according to merit; pension and life assurance schemes are in operation.—Write, giving full details in confidence, to Box 5288 [2916

THE *HAYES* COMPANY

RADIOGRAM CHASSIS
RADIO FEEDER UNITS



RG/250. 10 valve chassis with contrast expansion, variable selectivity, **£35.**
RG/160. 7 valve chassis, bass and treble controls, push-pull output, **£20.**
RG/127. 6 valve all-wave chassis with push-pull output. **£17/5/-.**
TU/100/6. All-wave tuning unit for use with amplifiers. 6.3 heaters. **£13/10/-.**
TU/100/4. For 4 v. heater supply. **£14.**
AC/DC models are available.
Full details gladly sent on request.
16 Mare Street, London, E.8. Amh 4400

Z & I AERO SERVICES LTD.
19, Buckingham Street, London, W.C.2.
Tel. TRAfalgar 2371/2
Special Supplies of Test Equipment to Laboratories: Signal Generators TF144G, Freq. Met. BC221, Output Power Mec. Type 8. Also American and British Aircraft, Radio and Test Equipment.
We urgently require American Equipment.

GOVERNMENT SURPLUS ELECTRICAL RADIO EQUIPMENT 76 PAGE ILLUSTRATED CATALOGUE 1/-, POST FREE. 2/6., OVERSEAS SEAMAIL
ARTHUR T. SALLIS (W.W.)
93 NORTH RD., BRIGHTON. *Tel: Brighton 25806*

BASS REFLEX CABINETS
Veneered and French polished from **£9.0.0.**
Complete Kits in un-veneered acoustic chipboard from **£3.15.0.** We will assemble for **7/6d.** extra.
CORNER CABINETS for Goodmans Axiom 150 MK.II, veneered and French polished **£16.0.0.** carr. paid. If without finishing mouldings **£1.0.0.** less.
A. DAVIES and Co. (Cabinet Makers), 3 Parkhill Place, off Parkhill Road, London, N.W.3
(Gulliver 5775)

·BRADMATIC·
HIGH CLASS
TAPE RECORDING EQUIPMENT
HEADS, DESKS, TAPE, ETC.
Send for lists
BRADMATIC LTD.
STATION ROAD, ASTON, BIRMINGHAM 6
Telephone: East 2881-2

GOODSELL LTD.
for High Fidelity Equipment
40 GARDNER ST., BRIGHTON, 1
Tel.: Brighton 26735

SITUATIONS VACANT

MINISTRY OF SUPPLY requires radio/radar technicians at Medmenham, Bucks, and Watton, Norfolk, to prepare schedules of radio/radar equipments and breakdown into assemblies, sub-assemblies and components. Quals. British of British parents. Recognised apprenticeship or equivalent. Appropriate experience. Able interpret drawings, circuit diagrams and specs. essential. O.N.C. or equivalent and practical experience R.A.F. equipments desirable. Salary. Within £480 (age 26)—£597 p.a. Not established but opportunities to compete for establishment may arise.—Apply nearest Employment Exchange quoting Order No. Westminster 2852. [2995

MARCONI'S WIRELESS TELEGRAPH Co., Ltd., Chelmsford, require research and development engineers for work on special applications of high power transmitters operating in the U.H.F. spectrum. There are vacancies for Senior and Junior Graduate Engineers with experience of the generation and transmission of microwave powers. The posts are permanent and pensionable and carry salaries in the range £660-£1,400 according to qualifications and experience. Five-day week. Canteen facilities, etc. Please write, giving full details of age, qualification, experience and present salary, and quoting reference 1117B. to—Marconi's Wireless Telegraph Co., Ltd., Dept. C.P.S., 336-7, Strand, W.C.2. [2811

ELECTRONIC engineers, senior and junior required; vacancies arise from an expansion of the company's business, which covers a wide field; applications are particularly welcome from young graduate engineers who have had some industrial experience; for the junior vacancies the minimum technical qualification required is the City & Guilds Certificate in Telecommunications; applications will be treated in strictest confidence; near city centre and all amenities; Saturday interview if required.—Apply Marconi Instruments, Ltd., Longacres, Hatfield Rd. St. Albans. [2766

AN electronic engineer, aged 25 to 35, is required to fill an interesting appointment in the Development Laboratory of the General Electric Company, Ltd., at Stanmore. Work involved will include development of airborne radar equipment and a knowledge of aircraft electrical installation would be useful. Possession of a University Degree is desirable and a knowledge of elementary physics would be advantageous. Applications should be made in writing to the Staff Manager (Ref. WW/AMMV) Brown's Lane Division, The General Electric Co., Ltd., Stanmore Laboratories, The Grove, Stanmore Common, Stanmore, Middlesex. [3012

JUNIOR development engineers are urgently required to assist in the development of precision electronic laboratory instruments. Successful applicants will be engaged on interesting long-term projects concerned with the development of a wide range of equipment. The appointments are permanent and carry considerable technical responsibility. Applicants should have had previous development experience, preferably in the instrument field. Academic qualifications ranging from O.N.C. to degree standard are acceptable. Salaries are dependent upon age, qualifications and experience.—Apply, stating full details, to the Chief Engineer, Messrs. Furzehill Laboratories, Ltd., Shenley Rd. Boreham Wood, Herts. [3030

ELECTRONICS engineers and physicists required by Ministry of Supply experimental establishments at Farnborough, Hants, Malvern, Worcs., Sevenoaks, Kent, and elsewhere, mainly in Southern England; duties include research development or design of telecommunications and radar equipment, guidance and control systems, instrumentation for variety of research problems; experience of V.H.F., pulse techniques, display systems, etc., desirable for some posts; appointments according to qualifications and experience as scientific officer (1st or 2nd class honours degree or equivalent) £445-£815; assistant experimental officer (Higher School Cert (science) or equivalent degree or H.N.C. may be an advantage and technical experience in Forces or industry desirable) £276 (age 18)-£615; experimental officer (H.S.C., etc., but min. age 26) £690-£850; women somewhat less; appointments unestablished; F.S.S.U benefits may be available for E.O. class.—Application forms from M.L.N.S., Technical and Scientific Register (E), 26, King St., London, S.W.1, quoting D296/54A. Closing date 13 July, 1954. [2981

WAR OFFICE require 3 technical assistants Grade II (unestablished) for Electronics Wing, R.E.M.E. Establishment, Malvern, Worcestershire. Duties are to collect and collate data for use in preparation of reports on newly developed electronics equipments and to write technical handbooks covering maintenance and repair of Army electronic equipments. Applicants must be British, of British parentage, possess an Ordinary National Certificate (or its equivalent), and have served suitable apprenticeship and have sound electronic knowledge. Experience of writing reports is desirable but not essential. Salary in range £592-£702 p.a. (at age 30), less £20 p.a. for every year under 30. Starting according to age, qualifications and experience. Annual increases subject to satisfactory service.—Write, giving date of birth, education, full details of qualifications and experience of posts held (including dates) to Appointments Officer, Ministry of Labour and National Service, 1-6, Tavistock Square, W.C.1, quoting E.C.214, by July 12th, 1954. No original testimonials should be sent. Only candidates selected for interview will be advised. [2922

SITUATIONS VACANT

AIR traffic control officers with experience offered permanent and pensionable posts at overseas airports, initial basic salary for licensed staff £500×£25 to £600 p.a. (unlicensed staff slightly lower) station allowance according to location, marital status, minimum total emoluments present posts, single staff £960 p.a., married staff £1,250 p.a., inclusive salary tax free, furnished quarters provided, generous paid U.K. leave, free air passages for staff and family, kit allowance, possibilities of promotion.—Qualified candidates, to whom replies only will be sent, write full particulars quoting A.T.C. to Personnel Officer, International Aeradio, Ltd., 40, Park St., W.1. [2991

MINISTRY of Supply requires experimental officers in guided weapons divisions of Royal Aircraft Establishment at Farnborough, Hants, and Aberporth, S. Wales; work concerned chiefly with design, development and performance of new weapons and associated guidance and control systems, instrumentation of flight trials and investigation of trials results; minimum qualification is Higher School Cert. (science) or equivalent, but further qualifications in mechanical, electrical or electronic engineering physics or maths. may be an advantage; appointments graded according to age, experience, etc., within ranges, experimental officer (min. age 26) £690-£850, or assistant experimental officer £276 (age 18)-£615; women somewhat less; appointments unestablished.—Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King St., London, S.W.1, quoting C.236/54A. Closing date July 13, 1954. [2906

AIR MINISTRY requires experimental glass A officers at establishment near Marlow, Bucks. Duties concern installation design of static and mobile radar and radio systems used by R.A.F. Work of engineering rather than laboratory type, covering wide range of application of electronic engineering to meet operational needs of R.A.F., with which very close contact is maintained. Accepted candidates are eligible for nomination for membership of Officers' Mess, offering recreational facilities in congenial surroundings. Qualifications—at least Higher School Cert. (Science) or equivalent, although higher qualifications in Physics or Electrical Engineering may be an advantage. Salaries within ranges: Experimental Officer (min. age 26) £690-£850 (male), or Assistant Experimental Officer £276 (at age 18) to £615 (male). Appointments unestablished. Application forms from M.L.N.S. Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D290/54A. Closing date July 13, 1954. [2926

MINISTRY of Supply, Radar Research Establishment, Malvern, Worcs, requires: ELECTRICAL Engineers and Physicists for research and development work on radio and electronic equipment; work ranges from fundamental research on circuitry and physics of solids, to devising and developing, in collaboration with industry, electronic devices for the Army, R.A.F. and Naval Aviation. Ample scope for initiative and originality over very wide field concerned mainly with electronics. Minimum qualification—Higher School Cert. (science) or equivalent, but further training in physics or elec. eng. to H.N.C. or degree standard may be an advantage. Salaries within ranges. Experimental Officer (min. age 26) £690-£850, or Assistant Experimental Officer £276 (age 18)—£615. Women somewhat less. Appointments unestablished.—Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting A121/54. Closing date July 13, 1954. [2909

SITUATIONS VACANT

THE TELEGRAPH CONSTRUCTION & MAINTENANCE Co., Ltd., cable manufacturers, have a vacancy for a technical assistant to be concerned with the development and manufacture of cable accessories; an important duty will be the preparation of technical information for commercial purposes; previous practical and commercial experience of cable accessories essential; salary range £550-£600 upwards according to qualifications and experience; pension scheme, five-day week and all welfare facilities.—Details to Staff Officer, Telcon Works, Greenwich, S.E.10. [2967

MINISTRY OF SUPPLY requires assistant foremen at Bickley, Kent, to assist development, supervise manufacture of special electronic test gear; quals. British of British parents, recognised apprenticeship or equivalent training in electronics, knowledge pulse techniques, UHF oscillators, oscilloscopes, high voltage measurement, ONC, City & Guilds or equivalent desirable; salary: within £506 (age 26)-£625 p.a.; not established but opportunities to compete for establishment may arise.—Apply any Employment Exchange quoting Order No. Westminster 2856. [3007

TECHNICAL TRAINING

CITY & GUILDS (Electrical, etc.) on "No Pass-No Fee" terms; over 95% successes; for full details of modern courses in all branches of Electrical Technology, send for our 144-page handbook—free and post free.—B.I.E.T. (Dept. 389A), 29, Wright's Lane, London, W.8. [0117

TUITION

COVENTRY TECHNICAL COLLEGE.

SESSION 1954-55.
ELECTRONIC Engineering.
APPLICATIONS invited for entry to 3-year full-time course commencing September, 1954, from those requiring comprehensive training to advanced level in Electronic Engineering, qualifying for technical posts in radio, telecommunications, television and industrial electronics. Syllabus will cover requirements of C. & G., Brit.I.R.E., and I.E.E. examinations. Entry age 16 or over. Application forms and further information from Principal, Technical College, The Butts, Coventry. [2866

NOTHING succeeds like success! What we have done a thousand times we can do again for you—see the B.N.R.S. advt., page 124. [0172

WIRELESS operating; attendance and postal courses.—Stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7. [0104

SEE the world as a radio officer, short training, low fees, scholarships, boarding/day students; stamp for prospectus.—Wireless College, Colwyn Bay. [0018

FULL-TIME courses for P.M.G. Certs., C.G.L.I. Telecommunications, Radar Maintenance Cert. and B.Sc.(Eng.); prospectus free.—Technical College, Hull. [0111

GRAMPIAN REPRODUCERS LTD
9 Hanworth Trading Estate, Feltham, Middx. Tel. Feltham 2657

TUITION

LEARN it as you do it.—We provide practical equipment combined with instruction in radio, television, etc.—Write for full details to E.M.I. Institutes, Dept. WW47, 43, Grove Park Rd., London, W.4. [0179

T/V & Radio.—A.M.Brit.I.R.E., City & Guilds, R.T.E.B. Cert., etc., on "no pass—no fee" terms. Over 95% successes. Details of Exams. & Home Training Courses in all branches of radio & T/V, write for 144-page handbook—free.—B.I.E.T. (Dept. 387B), 29, Wright's Lane, London, W.8. [0116

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc., on "no-pass—no fee" terms; over 95% successes; for details of exams. and courses in all branches of engineering, building, etc., write for 144-page handbook—free.—B.I.E.T. (Dept. 387B), 29, Wright's Lane, London, W.8. [0118

WIRELESS telegraphy: Merchant Navy offers to youths 16 upwards after qualification lucrative positions as Radio Officers.—Apply British School of Telegraphy, 179, Clapham Rd., S.W.9 (Est. 1906). Recognised by Ministry of Education. Moderate fees. Modern equipment. Also postal courses in theory of Wireless Telegraphy for P.M.G. Certs and Amateur Transmitting Licence. [0124

THE Institute of Practical Radio Engineers have available home study courses in every phase of radio and television engineering, specialising in the practical training of apprentices in the retail trade; enrolments limited, fees moderate.—The Syllabus of Instructional Text may be obtained post free from the Secretary, I.P.R.E., Fairfield House, 20, Fairfield Rd., Crouch End, London, N.8. [0088

THERE is a great future for qualified radio, television and electronic engineers; this is your opportunity to train for a well-paid career. E.M.I. Institutes offer a 3-year course in telecommunications engineering commencing August 30th; on successful completion employment is assured.—Full details from E.M.I. Institutes, Dept. WW38, 10, Pembridge Square, London, W.2. [2998

FREE! Brochure giving details of home study training in radio, television, and all branches of electronics; courses for the hobby enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds Telecommunications, R.T.E.B., and other professional examinations; train with the college operated by Britain's largest electronic organisation; moderate fees.—Write to E.M.I. Institutes, Postal Division, Dept. WW28, 43, Grove Park Rd., London, W.4. [0001

BOOKS, INSTRUCTIONS, ETC.

BOOKLETS "How to Use Ex-Govt. Lenses and Prisms." Nos. 1 and 2, price 2/6 each; ex-Govt. optical lists free for s.a.e.—H. English, Rayleigh Rd., Hutton Brentwood, Essex. [0181

I.P.R.E. technical publications, 5,500 Alignment Peaks for Superhsteterodynes, 5/9, post free; data for constructing TV aerial strength meter, 7/6; sample copy "The Practical Radio Engineer," quarterly publication of the Institute 2/-; membership and examination data, 1/—Sec., I.P.R.E., 20, Fairfield Rd., London, N.8. [0089

"GUIDE to Broadcasting Stations." Compiled by "Wireless World." Gives details of over 1,600 short-wave radio stations of the world and all European long- and medium-wave stations. Specially arranged for easy reference. 7th Edition. 2/- net from all booksellers, 2/2 by post from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

MAST HEAD UNITS
(Gain approximately 15 dBs. Noise factor approximately 2 dBs.)

Beautifully designed and engineered

Incorporating a Cascode connected amplifier and suitable for use with all types of aerials. Supplied complete with power supply unit and mounting bracket. Descriptive leaflet on request.

PRICE COMPLETE £19.0.0 (sent carriage paid at once on receipt of order)

SPENCER-WEST
QUAY WORKS, GT. YARMOUTH

The strange case of the varnished nylon

This young lady is about to leave for Equatorial Africa, where Varnished Nylon manufactured by our friend Symons is particularly trustworthy. Indeed, under tropical conditions anywhere it combines mechanical strength with excellent electrical properties. It has, observe, two notable features. As a straight cut tape it is sufficiently extensible to replace bias cut tape in many applications. Second, it has a far higher insulation resistance under humid conditions than any other varnished fabric. A pretty case *and* a pretty client, if I may say so.

VARNISHED NYLON

Available in both Yellow and Black qualities. Manufactured in 4, 5 and 6 mil thicknesses, straight or bias cut, in rolls 36" wide, or as tape, any width (English or Metric measure), with straight, slit or serrated edges.

Symons ADVISORY SERVICE

If you have an electrical insulation problem, send it to us! Our experts will be pleased to advise you.

TESTED FLEXIBLE INSULATION BY

H. D. Symons & Co. Ltd.

PARK WORKS KINGSTON HILL SURREY
KINGSTON 0911 INSULATION KINGSTON ON THAMES

TANNOY PRODUCTS
SOUND EQUIPMENT
clearly the best for all occasions
WEST NORWOOD, S.E.27. - GIPsy Hill 1131 (7 lines)

LOCKWOOD
makers of
Fine Cabinets
and woodwork of every description for the Radio and allied trades
LOCKWOOD & COMPANY
Lowland Rd., Harrow, Middlesex. Byron 3704

Chassis, Cases and all metal fittings made to specification for the Radio and Electronic Industry.
STAR METAL PLATE WORKS
74 CHURCH Rd. BARNES S.W.13

INDEX TO ADVERTISERS

	PAGE
Acoustical Mfg. Co., Ltd.	17
Adcola Products, Ltd.	30
A.D.S. Relays, Ltd.	92
Advance Components, Ltd.	6, 41
Aerialite, Ltd.	22
Aero Research, Ltd.	12
Airmec, Ltd.	27
Allen Components, Ltd.	54
Alpha Radio Supply Co., The	115
Altaflex, Ltd.	138
Altham Radio Co.	99
Amplex Appliances (Kent), Ltd.	104
Amplivox, Ltd.	32
Anders Electronics, Ltd.	66
Antex	50
Antiference, Ltd.	39
Appointments Vacant	94, 124, 139
Arcolectric Switches, Ltd.	46
Ariel Sound	138
Armstrong Wireless & Television Co., Ltd.	64, 131
Ashworth, H.	30
Automatic Coil Winder & Electrical Equipt. Co., Ltd., The	1, 16c
Bakers 'Selhurst' Radio	56
Barker Natural Reproducers	135
Bartons (Radio)	114
Beamish, T. W.	138
Belling & Lee, Ltd.	77
Bell, John, & Croyden	104
Bel Sound Products Co.	134
Benson, W. A.	129
Bird, S., & Sons, Ltd.	10
Birmingham Sound Reproducers, Ltd.	72
B.K. Partners, Ltd.	62
Bolton Education Committee	138
Boulton Paul Aircraft, Ltd.	101
Bradmatic, Ltd.	140
Britain, Chas. (Radio), Ltd.	116
British Communications Corpn., Ltd.	37
British Distributing Co.	122
British Institute of Engineering Technology	128, 134
British Insulated Callender's Cables, Ltd.	15
British National Radio School	124
British Physical Laboratories	28, 102
British Sarozal, Ltd.	124
Brookes Crystals, Ltd.	58
Brown, S. G., Ltd.	96
Bulgin, A. F., & Co., Ltd.	Edit. 355
Bullers, Ltd.	62
Bull, J., & Sons	102
Candler System Co.	132
Chaffey Cabinet Co., The	138
Champion Products	51
Chapman, C. T. (Reproducers), Ltd.	128
Cinema Television, Ltd.	57
City Sale & Exchange, Ltd.	100
Classic Electrical Co., Ltd.	59
Clydesdale Supply Co., Ltd.	114
Clyne Radio, Ltd.	119
Cohen, D.	119
Cosmocord, Ltd.	76
Coventry Radio	136
Cranston, A. A.	134
Davies, A., & Co.	140
Davis, Jack (Relays), Ltd.	104
Denco (Clacton), Ltd.	28, 135
Direct T.V. Replacements	126
Dixon, L., & Co.	122
Drayton Regulator & Instrument Co., Ltd.	56
Dubilier Condenser Co. (1925), Ltd.	32b
Duke & Co.	153
Dulci Co., Ltd., The	126
Dun-Sobieson Electrical Co.	136
E.A.P. (Tape Recorders), Ltd.	50
Easco Electrical, Ltd.	136
Edison Swan Electric Co., Ltd., The	Cover ii, 29, 49, 78
Egen Electric, Ltd.	26
Electrical Instrument Co. (Hillington), Ltd., The	68
Electrical Instrument Repair Service, The	132
Electric & Musical Industries, Ltd.	32d, 61
Electro Acoustic Developments	139
Electro Acoustic Industries, Ltd.	21
Electronic Instruments, Ltd.	56
Electronic Precision Equipment	88, 89
Electro-Winds, Ltd.	106
E.M.I. Institutes	24, 65, 85
English Electric Co., Ltd., The	45
Eta Tool Co. (Leicester), Ltd.	60
Ever Ready Co. (Gt. Britain), Ltd.	91
E.W.A.	136
Excel Sound Services, Ltd.	54
Fluxite, Ltd.	139
Foyle, W. & G., Ltd.	106
Furzehill Laboratories, Ltd.	20
Galpins	135
Gardners Radio, Ltd.	92
Garland Bros.	98
Gee Brcs. Radio, Ltd.	120
General Electric Co., Ltd.	16d, 93
Glaser, L., & Co.	134
Goodmans Industries, Ltd.	4, 33
Goodsell, Ltd.	140
Gramophone Co., Ltd., The	83
Grampian Reproducers, Ltd.	141
Gray, Arthur, Ltd.	94
Gresham Transformers, Ltd.	25
Grundig (Gt. Britain), Ltd.	24
Hall Electric, Ltd.	63
Hanney, L. F.	106
Harris, H.	126
Hartley, H. A., Co., Ltd.	58
Hatfield Instruments, Ltd.	44
Hayes Co., The	140
Henley's, W. T., Telegraph Works Co., Ltd.	132
Henry's	121
Hifi, Ltd.	60
Hivac, Ltd.	16a
Holley's Radio	90
Homelab Instruments, Ltd.	107
Household Electrix, Ltd.	95
H.P. Radio Services, Ltd.	104
Hunton, Ltd.	106
Hygrade Wire Co.	139
Iliffe books	16b, 32, 48, 62, 90, 96, 98, 105
Imhof, Alfred, Ltd.	55, 52
International Correspondence Schcol, Ltd.	100
Jackson Radio Supplies	137
Kenroy, Ltd.	130
Keyswitch Co., The	66
Koakie, B.	104
Lancaster Hi-Fidelity Acoustical Equipment Co.	106
Lasky's Radio	123
Leak, H. J., & Co., Ltd.	67
Lee Products (Gt. Britain), Ltd.	105
Leevers-Rich Equipment, Ltd.	68
Lewis Radio Co.	130
Light Soldering Developments, Ltd.	99
Lockwood & Co.	142
London Central Radio Stores	138
Lowther Mfg. Co.	40
L.R. Supply Company, Ltd.	95
Lyons Radio, Ltd.	128
Magnegraph Recording Co.	136
Magnetic Coatings, Ltd.	103
Magnetic Devices, Ltd.	9
Mail Order Supply Co.	31
Malvyn Engineering Works	130
Marconi Instruments, Ltd.	2
Marconi's Wireless Telegraph Co. Ltd.	13, 32c, 56a, 56d, 79, 82
Marks, C., & Co.	108
Martin, J. H.	128
McMurdo Instrument Co., Ltd., The	86
Measuring Instruments (Pullin), Ltd.	67
Midland Instrument Co.	120
Miers, N., & Co., Ltd.	107
Modern Book Co.	131
Modern Electrics, Ltd.	97
Modern Techniques	64
Morley Tranaformers	134
M.R. Supplies, Ltd.	64
Mullard, Ltd.	3, 7, 18, 46, 51, 74
Multicore Solders, Ltd.	Cover iv
Murex, Ltd.	52
Newtown Industries	128
Northall, L. C.	122
Northern Radio Services	127
Northern Transformer Co.	130
Norwood Technical College	138
Nu-Swift, Ltd.	152
Oddie Bradbury & Cull, Ltd.	134
Oryx Electrical Laboratories	50
Osmor Radio Products, Ltd.	42
Oxley Developments Co., Ltd.	126
Painton & Co. Ltd.	25
Palmer, C. A. Stanley	56
Parmeko, Ltd.	80
Parsonage, W. F., & Co., Ltd.	136
Partridge Transformers, Ltd.	125
P.C.A. Radio	120
Pearce, T. W.	129
Pitman, Sir Isaac, & Sons, Ltd.	133
Post Radio Supplies	128
Power Controls, Ltd.	43
Premier Radio Co.	69, 70, 71
Proops Bros., Ltd.	118
Pye, Ltd.	13, 54
Pye, W. G., & Co., Ltd.	94
Quartz Crystal Co., Ltd.	136
Radio & Electrical Mart, The	122
Radio Kits, Inc.	136
Radio Servicing Co.	105
Radiospares, Ltd.	132
Radio Supply Co.	112, 115
Radio Traders, Ltd.	116
Rediffon, Ltd.	56c
Reliance Mfg. Co. (Southwark), Ltd.	133
Reproducers & Amplifiers, Ltd.	47
R.M. Electric, Ltd.	48
Roding Laboratories	98
Rogers Developments Co.	44
Rola Celestion, Ltd.	97
Rollet, H., & Co., Ltd.	136
Rudman, Darlington (Electronics), Ltd.	67
Salford Electrical Instruments, Ltd.	11
Sallis, A. T.	140
Samson Surplus Stores	130
Sangamo Weston, Ltd.	86
Savage Transformers, Ltd.	129
Savage, W. Bryan, Ltd.	20
Service Radio Spares	122
Sherman's Supply Co.	137
Sherwood Instruments, Ltd.	136
Simmonds, L. E., Ltd.	54
Simon Sound Service, Ltd.	101
Smith, G. W. (Radio), Ltd.	108
Smith, H. L., & Co., Ltd.	138
Solatron Laboratory Instruments, Ltd.	55
Sound Sales, Ltd.	86
Southern Radio Supply, Ltd.	137
Spencer-West	141
Spicers, Ltd.	102
Standard Telephones & Cables, Ltd.	16, 56b, 75, 84
Star Metal Plate Works	142
Stern Radio, Ltd.	109, 110, 111
Stewart Transformers, Ltd.	52
Sugden, A. R., & Co. (Engineers), Ltd.	42
Supacoils	126
Supersonic Africa (Pty.), Ltd.	60
Sutton Coldfield Electrical Engineers	134
Symons, H. D., Ltd.	141
Tannoy Products, Ltd.	142
Taylor Tunnicliff & Co., Ltd.	8
Telcon-Magnetic Cores, Ltd.	68
Telecraft, Ltd.	136
Telegraph Condenser Co., Ltd.	Cover iii
Telegraph Construction & Maintenance Co., Ltd.	40
Telemechanics, Ltd.	90
Tele-Radio (1943), Ltd.	66
Teletron Co., The	134
Thomas, Richard & Baldwins, Ltd.	32a
Transradio, Ltd.	52, 100
Trix Electrical Co., Ltd.	Edit. 355
Truvox, Ltd.	22
Universal Electrical Instruments Corpn.	118
Universal Electronics	124
Universal Engineering Co.	106
Valradio, Ltd.	50
Venner Accumulators, Ltd.	65
V.E.S. Wholesale Services, Ltd.	122
Vortexion, Ltd.	81
Waterloo Radio	138
Wayne Kerr Laboratories, Ltd., The	53
Webber, R. A., Ltd.	68
Webb's Radio	38, 139
Westinghouse Brake & Signal Co., Ltd.	56
Weymouth Radio Mfg. Co., Ltd., The	56
Wharfedale Wireless Works	14
Whitaker, Harold	104
White, S.S. Co., of Gt. Britain, Ltd., The	26
Whittemore, A. J. (Aeradio), Ltd.	130
Wilco Electronics	132
Wilkinson, L.	122
Williams, L. G., Ltd.	66
Wright & Weaire, Ltd.	5
Young, C. H.	118
Z. & I. Aero Services, Ltd.	140

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford St., London, S.E.1, by CORNWALL PRESS LTD., Park Garden, London, S.E.1. Wireless World can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service Ltd.: Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd., William Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co.

FOCUS ON LEADERSHIP

HI-K MINIATURE CERAMICS

TRIMMER
Types CC164N
and CC165N

ACTUAL SIZE

LEAD-THROUGH AND STAND-OFF CONDENSERS have been designed for Television Receivers incorporating Band 3 and Band 4 tuners. Their outstanding features are: extremely small series inductance, efficient decoupling, small physical size and a capacity tolerance of —20% to +80%. The Stand-Off Types are particularly suitable for cathode and screen decoupling.

Capacity: 1,000 pF. Working Voltage: 350v. D.C. Insulation Resistance: greater than 5,000 megohms at 500v. D.C.

MINIATURE TRIMMERS were developed to provide pre-set adjustment of R.F. and Oscillator circuits in T.V. Tuners, and elsewhere.

Capacity sweeps supplied: 0.5 pF. to 3 pF., and 1 pF. to 5 pF. Temperature Coefficient: –40 10^{6}/°C. Working Voltage: 350v D.C. Insulation Resistance: greater than 10,000 megohms at 350v. D.C.

CONSTRUCTION

Lead-Through and Stand-Off: the tubular bodies are a specially selected material of the barium-titanite group of ceramics with a dielectric constant of 3,000. The four constructions provide two for lead-through, and two for stand-off purposes. The former have an 18 gauge tinned copper wire running through the body and protruding each end, whilst the latter have a looped termination at one end.

Trimmers: the 'live' electrode is a silvered band on the outside of the tube, contact being provided by a tinned copper wire termination. Variation in capacity is controlled by a screw in an internally threaded ceramic tube.

INSTALLATION

Lead-Through Type CC160S is for soldering direct into a tuner plate, through a 'burst' hole.

Lead-Through Type CC161S has a central flange so that it may be mounted on a tuner plate having a punched hole.

Stand-off Type CC162S has a mounting flange at the base enabling the condenser to be soldered to any part of a flat chassis.

Stand-off Type CC163S has a central mounting flange, and is mounted through a punched hole in the chassis.

Trimmer Types CC164N & CC165N. The square-section end is inserted in a suitably punched hole, thus preventing movement of the body during adjustment. The condenser is held by a spring fixing nut which locks the adjusting screw, and gives a low inductance connection to chassis.

TCC

THE TELEGRAPH CONDENSER CO. LTD.

NORTHUMBERLAND AVENUE, LONDON, W.C.2. TELEPHONE: ACORN 0123

SPECIALISTS IN CONDENSERS SINCE 1906

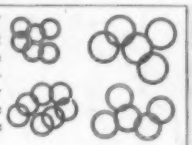
MULTICORE SOLDERS LTD.

7 LB. REEL is used by factories and is the most economical way of purchasing Multicore Solder. Supplied as standard in 6 alloys and 9 gauges.

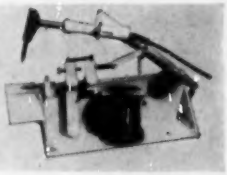
5 CORE SOLDER is now available in quantities. The 5 cores are situated very close to the circumference of the solder wire and allow the flux to be liberated very quickly. The use of this solder often allows an alloy of lower tin content to be used, with consequent saving in cost.

provide the correct alloy,

SOLDER RINGS of diameters between ⅛" and 2" and in gauges between 10 and 22 s.w.g. (according to diameters). They are suitable for many repetition soldering processes. Butt jointed and made in Arax or Ersin Multicore Solder, they cost only the price of the solder itself: there is no charge for making them.



AUTOMATIC SOLDERING HEAD feeds lengths of from $\frac{1}{16}$" to ¼" of Multicore Solder in any diameter between 13 and 19 s.w.g. as the electric iron descends. Can be supplied with motor or foot pedal or ready for installation to existing drive.



gauge, flux and packing for

TAPE SOLDER melts with a match, needs no soldering iron or extra flux. Particularly useful on jobs where no soldering iron is available. 1/- cards contain enough solder for about 100 average joints. Also supplied, for factory use, on 3½ lb. reels in widths from ⅛" to ½" and from .005" thick.

RADIO AND T/V SERVICE ENGINEER'S 1 LB. REEL is an economy pack for use where fair quantities of solder are required. Containing 167 feet of 18 s.w.g. 50/50 alloy Ersin Multicore Solder, it is a convenient size for Service Engineers and Workshops.

quick and efficient soldering

BIB WIRE STRIPPERS strip insulation or cut through flex as required. They also split extruded flex, doing the job quicker and better than the number of tools usually required.

LIQUID FLUXES For dipping purposes or other processes where it is not convenient to use Ersin Multicore Solder, Ersin non-corrosive Flux is available in liquid form. Ersin Jelly Flux with a high viscosity consistency is also available.

Ersin Multicore Solder, used all over the world by leading manufacturers of electrical equipment, is supplied containing 3 or 5 cores of Ersin Flux. The core construction ensures a continuous flux stream which, with the correct soldering technique, avoids dry or H.R. joints. The Ersin Flux prevents oxidation during soldering and cleans oxides from the surfaces to be soldered. During the past 15 years Multicore have specialised in making cored solder but, for the now comparatively small number of processes where solid solder is required, precision-made solder wire is available to special order. Paste, jelly and fluid fluxes are also available. Details of these and the fluid solders in paint or cream consistency will be sent on request. For details of a complete soldering process for printed circuits which has been developed by Multicore laboratories, please ask for publication Ref. PCL 100.

SIZE ONE CARTONS 5/- RETAIL

Cat. Ref. No.	Alloy Tin/Lead	S.W.G.	Approx. Length per carton
C16014	60/40	14	21 feet
C16018	60/40	18	55 ,,
C14013	40/60	13	19 ,,
C14016	40/60	16	38 ,,

MULTICORE SOLDERS LTD., MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS. (BOXMOOR 3636)